DRAFT ENVIRONMENTAL ASSESSMENT
for the Total Allowable Catch Specifications for the Year 2002
Alaska Groundfish Fisheries

Implemented Under the Authority of the
Fishery Management Plans
for the
Groundfish Fishery of the Bering Sea and Aleutian Islands Area
and
Groundfish of the Gulf of Alaska

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Abstract: This Environmental Assessment analyzes the impacts of establishing the 2002 harvest specifications for groundfish target species in the groundfish fisheries of the Bering Sea, Aleutian Islands and Gulf of Alaska. Impacts are considered to target species stocks, higher and lower trophic level species, and the physical and socioeconomic environment for five alternative TAC specifications. The preferred alternative is to set harvest within the range of ABCs recommended by the Council Plan Teams as modified by the North Pacific Fisheries Management Council (Council) (Alternative 2). Revisions will be based upon comments and recommendations received during the Council meeting December 3-10, 2001. The federal action consists of specifying groundfish total allowable catch limits for fishing year 2002 in the exclusive economic zones of the Bering Sea and Aleutian Islands management area and the Gulf of Alaska management area.

Public Comments Due by December 11, 2001.

Total Allowable Catch Specifications for the Year 2002
Environmental Assessment

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Total Allowable Catch Specifications for the Year 2002
Environmental Assessment

1.0 Purpose and Need

The purpose of this environmental assessment (EA) is to determine whether the impacts to the human environment resulting from setting the 2002 total allowable catch (TAC) specifications are significant. If impacts predicted to result from the preferred alternative are insignificant, and that alternative is the chosen one, no further analysis is necessary to comply with the requirements of the National Environmental Policy Act.

TAC specifications define upper retained harvest limits, or fishery removals, for the subject fishing year. Catch specifications are made for each managed species or species group, and in some cases, by species and sub-area. Sub-allocations of TAC are made for biological and socio-economic reasons according to percentage formulas established through fishery management plan (FMP) amendments. For particular target fisheries, TAC specifications are further allocated within management areas (Eastern, Central, Western Aleutian Islands; Bering Sea; Western, Central, and Eastern Gulf of Alaska) among management programs (open access or community development quota program), processing components (inshore or offshore), specific gear types (trawl, non-trawl, hook-and-line, pot, jig), and seasons according to regulations § 679.20, § 679.23, and § 679.31. TAC can be sub-allocated to the various gear groups, management areas, and seasons according to pre-determined regulatory actions and for regulatory announcements by NMFS management authorities opening and closing the fisheries accordingly. The entire TAC amount is available to the domestic fishery. The gear authorized in the Federally managed groundfish fisheries off Alaska includes trawl, hook-and-line, longline pot, pot, and jig (50 CFR 679.2).

Fishing areas correspond to the defined regulatory areas within the fishery management units. The BSAI is divided into nineteen reporting areas, some of which are combined for TAC specifications purposes. The Aleutian Islands group comprises regulatory Areas 541, 542, and 543. When the Aleutian Islands are referred to individually, 541 represents the Eastern Aleutian Islands, 542 the Central Aleutian Islands, and 543 the Western Aleutian Islands. The GOA is divided into eight reporting areas. The Western Gulf is Area 610, the Central Gulf includes Areas 620 and 630, and the Eastern Gulf includes Areas 640 and 650. State waters in Prince William Sound is Area 649. State waters in southeast Alaska is Area 659.

The fishing year coincides with the calendar year, January 1 to December 31 (§ 679.2 and 679.23). Depending on the target species' spatial allocation, additional specifications are made to particular seasons (defined portions of the year or combinations of defined portions of the year) within the fishing year. Any TACs not harvested during the year specified are not rolled over from that fishing year to the next. Fisheries are opened and closed by regulatory announcement. Closures are made when inseason information indicates the apportioned TAC or available prohibited species catch (PSC) limit has been or will soon be reached, or at the end of the specified season, if the particular TAC has not been taken.

TAC specifications for the federal groundfish fisheries are set annually. The process includes review by the North Pacific Fishery Management Council (Council), its Advisory Panel, and its Scientific and Statistical

Committee of the SAFE reports (Appendices A, B, C, and D). Using the information from the SAFE Reports and the advice from Council committees, the Council makes both ABC and TAC recommendations toward the next year's TAC specifications. NMFS packages the recommendations into specification documents and forwards them to the Secretary of Commerce for approval.

1.1 Related NEPA Documents

The original EISs for the BSAI and GOA FMPs were completed in 1981 and 1979, respectively. The TAC setting process was not revisited in an EIS until 1998, when an SEIS on the process of TAC setting was completed in December, 1998 (NMFS,1998a). In that document the impacts of groundfish fishing over a range of TAC levels was analyzed. The five alternatives were very similar to the alternatives considered in this 2002 TAC specifications EA. The Record of Decision in that action was affirmation of the status quo alternative for TAC-setting. Impacts to the human environment from the federal groundfish fisheries were displayed in that EIS.

In addition to the TAC-setting EIS analysis, environmental assessments have been written to accompany each new year's TAC specifications since 1991. The most recent year (2001) was handled a little differently because of Endangered Species Act (ESA) considerations for Steller sea lions that coincided with setting the 2001 TAC specifications. Those harvest specifications were promulgated by emergency rule in January 2001 without an accompanying NEPA analysis. When the emergency rule was extended and revised in July of 2001 it was accompanied by an EA/RIR (NMFS, 2001b). The 1991 through 2001 TAC-setting EAs have been predominantly descriptive. Descriptions included lists of species present in the action area, overviews of the life histories of the marine species, discussions of effects to marine species that may result from fish harvesting activities, and descriptions of the federal fisheries management processes.

In addition to TAC-setting (project specific) EA and EIS NEPA analyses, a draft programmatic SEIS has been prepared and circulated for public review and comment (NMFS, 2001a). The analysis evaluates the BSAI and GOA groundfish FMPs in their entirety against policy level alternatives. The programmatic SEIS provides insight as to what environmental effects would result from other fisheries management regimes within an analytical framework. Findings of that analysis could result in FMP amendments that could lead to formal rulemaking and implementation of changes to the current management policy governing the groundfish fisheries off Alaska. The public comment period on the draft programmatic SEIS was from January 25, 2001, through July 25, 2001. Finalization of that document is not expected within the near future.

A supplemental environmental impact statement was prepared in 2001 (NMFS 2001c) to evaluate modifications of fishery management measures being made to mitigate impacts on Steller sea lions. The purpose of that SEIS was to provide information on potential environmental impacts that could occur from implementing a suite of fisheries management measures such that the western population of Steller sea lions existence is not jeopardized nor its critical habitat adversely modified by the groundfish fisheries in the GOA and the BSAI. Fisheries management measures considered were designed to allow commercial groundfish fishing in the North Pacific while assuring that the fisheries would neither jeopardize the continued existence of both western and eastern Steller sea lion stocks, nor adversely affect their critical habitat. Alternative 4, the area and fishery specific approach, was selected as the preferred alternative. The modifications to fishery management measures encompassed in that alternative will be enacted with the emergency rule that promulgates the 2002 TAC specification decisions being informed with this analysis.

1.2 Description of the Fisheries

Detailed descriptions of the fishery may be found in the following reports (all made public during 2001 and all readily available in printed form or over the Internet at links given in the references):

Alaska Groundfish Fisheries. Draft Programmatic Supplemental Environmental Impact Statement (NMFS, 2001a). This report contains detailed fishery descriptions and statistics in Section 3.10, "Social and Economic Conditions," and in its Appendix I, "Sector and Regional Profiles of the North Pacific Groundfish Fisheries."

"Economic Status of the Groundfish Fisheries off Alaska, 2000" (Terry and Hiatt, 2001). is also known as the "2001 Economic SAFE Report." This document is produced and updated each Fall in the Alaska Fisheries Science Center. The 2001 edition contains 49 historical data tables summarizing a wide range of fishery information through the year 2000.

Steller Sea Lion Protection Measures Supplemental Environmental Impact Statement (NMFS, 2001c) contains several sections with groundfish fishery descriptions focused on three species - pollock, Pacific cod, and Atka mackerel. Section 2.3 goes through a complete set of calculations for TAC by area, species, season, and gear using 2001 stock assessment to show what will result from the modifications to management measures to avoid jeopardy to Steller sea lions and adverse modification of critical habitat. Section 3.12.2 provides extensive background on existing social conditions, Appendix C provides extensive information on fishery economics, Appendix D provides extensive background information on groundfish markets, Appendix E documents harvest amounts and location by week throughout one fishing year.

Draft Environmental Impact Statement for American Fisheries Act Amendments 61/61/13/8 (NMFS 2001d) provides a survey of the Bering Sea and Aleutian Islands groundfish fishery paying particular attention to the pollock fishery and the management changes introduced into it following the American Fisheries Act. The fisheries information is contained in Section 3.3, "Features of the human environment."

2.0 Descriptions of Alternatives

The alternatives evaluated are variations of amounts of total allowable catch that could be set for managed species and species groups. The combined TAC would still have to be within overall conservation limits established by the fishery management plans. Setting TAC above the overfishing level determined for a particular target species or target species group for the upcoming fishing year is an alternative that was considered, but ruled out as unlikely, therefore not analyzed in detail. Differences between alternatives are the TAC levels set by species and species group within the two groundfish complexes. Alternative TAC levels are evaluated to display a wide range of viable alternatives and their impacts to the environment. The measurable impacts of an alternative TAC specification accrue to the target resources themselves, other species in the ecosystem, the state fisheries that occur in adjacent marine waters, and those that benefit both from consumptive and non-consumptive users of living marine resources. The harvest levels contemplated by species by alternative are summarized in Tables 2.0-1 and 2.0-2. Acceptable biological catch (ABC) is

included at the draft EA stage because that is what is available from the Council's Plan Teams. These ABC data will be changed to total allowable catch (TAC) as the decision making moves through the North Pacific Fishery Management Council process. Fishing mortality (retained and discarded) is indicated as F.

2.1 TAC Alternative 1: Set F equal to $maxF_{ABC}$, "$maxF_{ABC}$" refers to the maximum permissible value of F_{ABC} under Amendment 56. Historically, TAC has been constrained by ABC, so this alternative provides a likely upper limit for setting TAC within the limits established by the fishery management plan. (Column 1 of Tables 2.0-1 and 2.0-2).

2.2 TAC Alternative 2: Preferred Alternative. Set F within the range of ABCs recommended by the Plan Team's and TACs recommended by the Council. Under this scenario, F is set equal to a constant fraction of $maxF_{ABC}$, where this fraction is equal to the ratio of the F_{ABC} value recommended in the assessment to the $maxF_{ABC}$. The recommended fractions of $maxF_{ABC}$ may vary among species or stocks, based on other considerations unique to individual species or stocks. (Column 2 of Tables 2.0-1 and 2.0-2).

2.3 TAC Alternative 3: Set F equal to 50% of $maxF_{ABC}$. This alternative provides a likely lower bound on F_{ABC} that still allows future harvest rates to be adjusted downward should stocks fall below reference levels. (Column 3 of Tables 2.0-1 and 2.0-2).

2.4 TAC Alternative 4: Set F equal to the most recent five year average actual F. This alternative recognizes that for some stocks, TAC may be set well below ABC, and recent average F may provide a better indicator of F_{TAC} than F_{ABC}. (Column 4 of Tables 2.0-1 and 2.0-2).

2.5 TAC Alternative 5: Set F equal to zero. This alternative recognizes that, in extreme cases, TAC may be set at a level close to zero. This is the no action alternative. Alternative 5, effectively, "set all TACs equal to zero," has been chosen as the baseline alternative, against which the impacts of the other alternatives have been measured. This has been done to simplify the comparison of the alternatives and does not imply any preference among them. (Column 5 of Tables 2.0-1 and 2.0-2).

Regulations at 50 CFR §679.20(a) specify that the annual optimal yield (OY) for groundfish in the BSAI is 1.4 to 2.0 million metric tons. The optimal yield in the GOA is 116,000 to 800,000 metric tons. The sum of the annual TACs in each year cannot be greater than the optimal yield in that area. While the sum of TACs in the GOA implied by the different alternatives do not approach the upper end of the OY range in 2002, in the BSAI Alternatives 1 and 2, as constituted, both totals exceed the OY. Before a decision on TAC specifications is made, however, individual target species or species groups TACs will be reduced to bring the overall total within bounds specified by the FMPs.

Table 2.0-1 2002 BSAI Specification for Alternatives 1 through 5

Species	Area		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Pollock	EBS		2,269,000	2,269,000	1,248,000	1,190,000	0
		Aleutian Islands	23,750	23,750	11,675	2,000	0
		Bogslof District	34,800	34,800	17,400	1,000	0
Pacific cod	BSAI		235,500	223,500	133,500	168,600	0
Sablefish	BS		2,386	1,903	1,199	1,804	0
		AI	3,195	2,595	1,635	2,460	0
Atka mackerel	Total		71,353	48,973	37,801	35,898	0
		WAI					0
		EAI/BS					0
		CAI					0
Yellowfin sole	BSAI		114,924	114,924	58,907	103,519	0
Rock sole	BSAI		225,121	225,121	116,768	41,842	0
Greenland turbot	Total		30,160	8,092	15,804	6,831	0
		BS					0
		AI					0
Arrowtooth flounder	BSAI		113,333	113,333	59,467	9,483	0
Flathead sole	BSAI		82,572	82,572	43,360	16,555	0
Other flatfish	BSAI		142,764	142,764	75,608	16,422	0
Pacific ocean perch	BSAI		14,776	14,776	7,471	12,352	0
	BS						0
		AI total					0
		WAI					0
		CAI					0
		EAI/BS					0
Sharpchin/Northern	BSAI		6,764	6,764	3,382	4,556	0
		BS					0
		AI					0
Shortraker/Rougheye	BSAI		1,029	1,029	515	811	0
		BS					0
		AI					0
Other rockfish	BS		361	361	181	607	0
		AI	676	676	338		0
Squid	BSAI		1,970	1,970	985	836	0
Other species	BSAI		19,320	19,320	9,660	22,901	0
Total			3,393,754	3,336,223	1,843,655	1,638,477	0

Table 2.0-2 2002 GOA Specifications for Alternatives 1 through 5.

Species	Area	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Pollock (1)	610	21,370	17,730	10,730	22,690	0
	620	27,770	23,045	13,950	29,500	0
	630	11,870	9,850	5,960	12,610	0
	640	1,400	1,165	705	1,490	0
Subtotal WYK/C/W		62,410	51,790	31,345	66,290	0
	650	6,460	6,460	100	3,230	0
Total GOA		68,870	58,250	31,445	69,520	0
Pacific cod (2)	GOA	65,200	57,600	32,600	66,670	0
	W	30,640	27,070	15,320	31,340	0
	C	29,340	25,920	14,670	30,000	0
	E	5,220	4,610	2,610	5,330	0
Flatfish	GOA	49,550	49,550	24,775	5,890	0
Shallow water	W	23,550	23,550	11,775	2,800	0
	C	23,080	23,080	11,540	2,740	0
	WYK	1,180	1,180	590	140	0
	SEO	1,740	1,740	870	210	0
Rex sole	GOA	9,470	9,470	4,735	3,650	0
	W	1,280	1,280	640	490	0
	C	5,540	5,540	2,770	2,140	0
	WYK	1,600	1,600	800	620	0
	SEO	690	1,050	345	60	0
Flathead sole	GOA	22,690	22,690	11,345	1,890	0
	W	9,000	9,000	4,500	750	0
	C	11,410	11,410	5,705	950	0
	WYK	1,590	1,590	795	130	0
	SEO	690	690	345	60	0
Flatfish	GOA	4,880	4,880	2,440	2,260	0
Deep water	W	180	180	90	80	0
	C	2,220	2,220	1,110	1,030	0
	WYK	1,330	1,330	665	620	0
	SEO	1,150	1,150	575	530	0
Arrowtooth flounder	GOA	146,260	146,260	73,120	18,210	0
	W	16,690	16,960	8,480	2,110	0
	C	106,580	106,580	53,290	13,270	0
	WYK	17,150	17,150	8,575	2,140	0
	SEO	5,570	5,570	2,785	690	0
Sablefish (3)	GOA	21,300	12,820	10,650	13,610	0
	W	2,760	2,240	1,380	2,380	0
	C	6,680	5,430	3,340	5,760	0
	WYK	2,390	1,940	1,195	1,880	0
	SEO	3,950	3,210	1,975	3,590	0
Pacific ocean perch	GOA	13,190	13,190	6,595	9,500	0
	W	2,610	2,610	1,305	1,880	0
	C	8,220	8,220	4,110	5,920	0
	WYK	780	780	390	1,500	0
	SEO	1,580	1,580	790	200	0

Species	Area	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Shortraker/rougheye	GOA	1,630	1,620	810	1,610	0
	W	220	220	110	210	0
	C	840	840	420	840	0
	E	560	560	280	560	0
Other rockfish	GOA	5,040	5,040	2,520	870	0
	W	90	90	45	20	0
	C	550	550	275	100	0
	WYK	260	260	130	650	0
	SEO	4,140	4,140	2,080	100	0
Northern rockfish	GOA	4,980	4,980	2,490	3,610	0
	W	810	810	405	590	0
	C	4,170	4,170	2,085	3,020	0
	E	0	0	0	0	0
Pelagic shelf rockfish	GOA	5,490	5,490	2,745	3,310	0
	W	510	510	255	310	0
	C	3,480	3,480	1,740	2,100	0
	WYK	640	640	320	850	0
	SEO	860	860	430	50	0
Thornyhead rockfish	GOA	2,500	1,990	1,250	1,260	0
	W	450	360	225	230	0
	C	1,050	840	525	530	0
	E	1,000	790	500	500	0
Demersal shelf rockfish	SEO	430	350	215	350	0
Atka mackerel	GW	4,700	600	2,350	530	0
Subtotal		423,065	394,780	209,023	202,570	0
Other species (4)	GW	21,153	19,740	10,451	10,129	0
Total		444,238	414,520	219,474	212,699	0

Notes

1. WYK/C/W ABC is reduced by 1,700 mt, the GHL established for the PWS 2002 pollock fishery.

2. Pacific cod apportionments of ABC are based on 2001 NMFS survey biomass distribution of 47%, 45%, and 8% in the W/C/E Regulatory Areas of the GOA respectively. The Council may wish to consider an alternative method of apportioning the GOA ABC based on the average of the three most recent NMFS surveys which results in an estimate of biomass distribution of 39%, 55%, and 6% in the W/C/E Regulatory Areas respectively. Note that these ABCs have not been adjusted for P cod GHL levels in the state waters seasons in the GOA which in previous years has been a consideration in setting TAC levels for the GOA.

3. Sablefish ABCs in the Eastern GOA reflect a subtraction of 5% of the ABC apportionment from SEO District added to the WYK District so that 5 % of the combined ABC for the Eastern GOA may be allocated to trawl gear in the WYK District without affecting the 95% allocation to hook-and-line gear in the WYK and SEO Districts.

4. ABC for the other species assemblage is not specified, rather TAC is set at 5% of the combined total of other groundfish TACs. Note that the council often sets TACs for several targets at levels below ABC, e.g. arrowtooth.

3.0 Affected Environment

The other NEPA documents listed above contain extensive information on the fishery management areas, marine resources, ecosystem, social and economic parameters of these fisheries and the TAC setting process. Rather than duplicate an affected environment description here, readers are referred to those documents. Additionally, Ecosystem Considerations for 2002 section of the SAFE reports are included as Appendix C to this EA. It contains summaries and pointers to recent studies and information applicable to understanding and interpreting the criteria used to evaluate significance of impacts that will result from setting harvest quotas at levels contemplated under these five alternatives.

4.0 Environmental and Economic Consequences

This section forms the scientific and analytic basis for the issue comparisons across alternatives. As a starting point, each alternative under consideration is perceived as having the potential to significantly affect one or more components of the human environment. Significance is determined by considering the context in which the action will occur and the intensity of the action. The context in which the action will occur includes the specific resources, ecosystem, and the human environment affected. The intensity of the action includes the type of impact (beneficial versus adverse), duration of impact (short versus long term), magnitude of impact (minor versus major), and degree of risk (high versus low level of probability of an impact occurring). Further tests of intensity include: (1) the potential for compromising the sustainability of any target or non-target species; (2) substantial damage to marine habitats and or essential fish habitat; (3) impacts on public health or safety; (4) impacts on endangered or threatened species or critical habitat of listed species; (5) cumulative adverse effects; (6) impacts on biodiversity and ecosystem function; (7) significant social or economic impacts; and (8) degree of controversy (NAO 216-6, Section 6.02).

Differences between direct and indirect effects are primarily linked to the time and place of impact. Direct effects are caused by the action and occur at the same time and place. Indirect effects occur later in time and/or further removed in distance from the direct effects (40 CFR 1508.27). For example, the direct effects of an alternative which lowers the harvest level of a target fish could include a beneficial impact to the targeted stock of fish, a neutral impact on the ecosystem, and an adverse impact on net revenues to fishermen, while the indirect effects of that same alternative could include beneficial impacts on the ability of Steller sea lions to forage for prey, neutral impacts on incidental levels of prohibited species catch, and adverse impacts in the form of multiplier effects reducing employment and tax revenues to coastal fishing communities.

The intent of TAC setting deliberations is to strike a balance between amounts of fish taken by these fisheries during fishing year 2002 and amounts left in the water. The effects of the alternatives must be evaluated for all resources, species, and issues that may directly or indirectly interact with these fisheries within the action area as result of TAC levels set. The direction of impact intensity applies to the particular resource, species, or issue being evaluated (as opposed to always applying to the target species).

Each section below contains an explanation of the criteria used to establish significance and a determination of significance, insignificance or unknown for each resource, species, or issue being treated. The criteria for significance are summarized in each section. The following ratings for significance are used; significant (beneficial or adverse), insignificant, and unknown. Where sufficient information on direct and indirect effects is available, rating criteria are quantitative in nature. In other instances, where less information is available, the discussions and rating criteria used are qualitative in nature. In instances where criteria to

determine an aspect of significance (significant adverse, insignificant, or significant beneficial) do not logically exist, no criteria are noted. These situations are termed "not applicable" in the criteria tables. An example of an undescribable situation is evaluating the impact vector of incidental take on marine mammals. In that situation, criteria to determine significant adverse and insignificant are describable (though with less precision than perhaps desired by decision makers), however, within the band of effects known to be insignificant the point of no incidental take impact is reached, therefore, a criterion for significant beneficial is not applicable.

The rating terminology used to determine significance is the same for each resource, species, or issue being treated, however, the basic "perspective" or "reference point" differs depending on the resource, species or issue being treated. Table 4.0-1 summarizes the reference points for the topics addressed in this analysis. The first three reference points relate to the biological environment, while the latter two are associated with the human environment. For each resource or issue evaluated, specific questions were considered in the analysis. In each case, the questions are fundamentally tied to the respective reference point. The generic definitions for the assigned ratings are as follows:

S+ Significant beneficial effect in relation to the reference point; this determination is based on interpretations of available data and the judgement of the analysts who addressed the topic.

I Insignificant effect in relation to the reference point; this determination is based upon interpretations of data, along with the judgement of analysts, which suggests that the effects are small and within the "normal variability" surrounding the reference point. When evaluating an economic or management issue it is used when there is evidence the status quo does not positively or negatively affect the respective factor.

S- Significant adverse effect in relation to the reference point and based on interpretations of data and the judgement of the analysts who addressed the topic.

U Unknown effect in relation to the reference point; this determination is made in the absence of information or data suitable for interpretation with respect to the question of the impacts on the resource, species, or issue.

Table 4.0-1 Reference points for significance determinations

Reference Point	Application
Current population trajectory or harvest rate of subject species	(1) Marine mammals (2) Target commercial fish species (3) Incidental catch of non-specified species (4) Forage species (5) Prohibited species bycatch (6) ESA list Pacific salmon (7) Seabirds
Current size and quality of marine benthic habitat and other essential fish habitat	Marine benthic habitat and other essential fish habitat
Application of principles of ecosystem management	Ecosystem
Current management and enforcement activities	(1) State of Alaska managed fisheries (2) Management complexity and enforcement
Current rates of fishing accidents	Human safety and private property (vessels)

4.1 Effects on Target Species

The general impacts of fishing mortality within FMP Amendment 56/56 ABC/OFL definitions are discussed in Section 2.7.4 of the Draft Programmatic SEIS (NMFS 2001a), and apply to all fish species for which a TAC is specified. Beginning in 2002, a modified harvest control rule will apply to the directed fisheries for pollock, Pacific cod, and Atka mackerel that will result in no directed fisheries when the spawning biomass is estimated to be less than 20% of the projected unfished biomass. This new harvest control rule was evaluated in the Steller Sea Lion Protection Measures SEIS (NMFS 2001c).

Assessing the effects of each alternative on target commercial fish species was accomplished by asking the following questions of each of the five alternatives for each target species or species group for which a TAC amount is being specified:

1. How much effect does the alternative have on fishing mortality?
2. How much effect does the alternative have on spatial or temporal concentration of the species?
3. How much effect does the alternative have on the availability of prey for the target species?
4. How much effect does the alternative have on the target species' habitat?

The reference point against which each question is assessed is the current population trajectory or harvest rate of the subject target fish species (Table 4.1-1).

4.1.1 Effects of Alternatives 1 Through 5 on Target Species

Analyses are prepared for each stock, species or species group in the Bering Sea and Aleutian Islands and the Gulf of Alaska and are contained in the stock assessment and fishery evaluation reports (Appendix A and B). The criteria used to estimate the significance of direct and indirect impacts of TAC setting Alternatives 1 through 5 on the BSAI and GOA stocks of target species are summarized in Table 5.0-1. The ratings utilize

a minimum stock size threshold (MSST) as a basis for positive or negative impacts of each alternative. A thorough description of the rationale for the MSST can be found in the National Standard Guidelines 50 CFR Part 600 (Federal Register Vol. 63, No. 84, 24212 - 24237). Under all alternatives, the spawning stock biomass of all target species that have calculated spawning stock biomasses are expected to be above their MSST. The probability that overfishing would occur is low for all of the stocks. The target species stocks that have calculated MSSTs are currently above their MSSTs and the expected changes that would result from harvest at the levels proposed are not substantial enough to expect that the genetic diversity of reproductive success of these stocks would change. None of the alternatives would allow overfishing of the spawning stock. Therefore the genetic integrity and reproductive potential of the stocks should be preserved.

Impacts to the target species stock, species or species group are predicted to be insignificant for all target fish evaluated because the following significance criteria are met: (1) they would not be expected to jeopardize the capacity of the stock to produce maximum sustainable yield on a continuing basis; (2) they would not alter the genetic sub-population structure such that it jeopardizes the ability of the stock to sustain itself at or above the minimum stock size threshold; (3) they would not alter harvest levels such that it jeopardizes the ability of the stock to sustain itself at or above the minimum stock size threshold; (4) they would not alter harvest levels or distribution of harvest such that prey availability would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold; and (5) they would not disturb habitat at a level that would alter spawning or rearing success such that it would jeopardize the ability of the stock to sustain itself at or above the minimum stock size threshold. See the individual species and species groups stock assessments in the SAFE reports (Appendix A and B) for additional information and documentation of this year's assessment process.

Table 4.1-1 Criteria used to estimate the significance of effects on targeted groundfish stocks in the Bering Sea, Aleutian Islands, and Gulf of Alaska

Intensity of the Effects				
Direct Effects	Significant Adverse	Unknown	Insignificant Impact	Significant Beneficial
Fishing mortality	Reasonably expected to jeopardize the capacity of the stock to produce MSY on a continuing basis: mean F2001-2006>FOFL	Unknown fishing mortality rate	Reasonably *not* expected to jeopardize the capacity of the stock to produce MSY on a continuing basis: mean F2001-2006<=FOFL	NA
Spatial temporal distribution of catch				
Leads to change in genetic structure of population	Evidence of genetic sub-population structure and evidence that the distribution of harvest leads to a detectable reduction in genetic diversity such that it jeopardizes the ability of the stock to sustain itself at or above the MSST	MSST and genetic structure is unknown, therefore no information to evaluate whether distribution of the catch changes the genetic structure of the population such that it jeopardizes *or* enhances the ability of the stock to sustain itself at or above the MSST	Evidence that the distribution of harvest is *not* sufficient to alter the genetic sub-population structure such that it jeopardizes the ability of the stock to sustain itself at or above the MSST	Evidence of genetic sub-population structure and evidence that the distribution of harvest leads to a detectable increase in genetic diversity such that it enhances the ability of the stock to sustain itself at or above the MSST
Change in reproduc-tive success	Evidence that the distribution of harvest leads to a detectable decrease in reproductive success such that it jeopardizes the ability of the stock to sustain itself at or above MSST	MSST is unknown therefore no information regarding the potential impact of the distribution of the catch on reproductive success such that it jeopardizes *or* enhances the ability of the stock to sustain itself at or above the MSST	Evidence that the distribution of harvest will *not* change reproductive success such that it jeopardizes the ability of the stock to sustain itself at or above the MSST	Evidence that the distribution of harvest leads to a detectable increase in reproduc-tive success such that it enhances the ability of the stock to sustain itself at or above MSST

Intensity of the Effects				
Indirect Effects	Significant Adverse	Unknown	Insignificant	Significant Beneficial
Change in prey availability	Evidence that current harvest levels and distribution of harvest lead to a change prey availability such that it jeopardizes the ability of the stock to sustain itself at or above the MSST	MSST is unknown therefore no information that current harvest levels and distribution of harvest lead to a change in prey availability such that it enhances *or* jeopardizes the ability of the stock to sustain itself at or above the MSST	Evidence that current harvest levels and distribution of harvest do *not* lead to a change in prey availability such that it jeopardizes the ability of the stock to sustain itself at or above the MSST	Evidence that current harvest levels and distribution of harvest lead to a change prey availability such that it enhances the ability of the stock to sustain itself at or above the MSST
Habitat: Change in suitability of spawning, nursery, or settlement habitat, etc. due to fishing	Evidence that current levels of habitat disturbance are sufficient to lead to a decrease in spawning or rearing success such that it jeopardizes the ability of the stock to sustain itself at or above the MSST	MSST is unknown therefore no information that current levels of habitat disturbance are sufficient to lead to a detectable change in spawning or rearing success such that it enhances *or* jeopardizes the ability of the stock to sustain itself at or above the MSST	Evidence that current levels of habitat disturbance are not sufficient to lead to a detectable change in spawning or rearing success such that it jeopardizes the ability of the stock to sustain itself at or above the MSST	Evidence that current levels of habitat disturbance are sufficient to lead to an increase in spawning or rearing success such that it enhances the ability of the stock to sustain itself at or above

4.2 Effects on Incidental Catch of Non-specified Species

The information available for non-specified species is much more limited than that available for target fish species. Estimates of biomass, seasonal distribution of biomass, and natural mortality are unavailable for most non-specified species. Predictions of impacts from different levels of harvest are therefore qualitatively described. Management concerns, data limitations, research in progress, and planned research to address these concerns are discussed in Section 4.5 of the Draft Programmatic SEIS (NMFS, 2001a). Direct effects include the removal of non-specified species from the environment as incidental catch in the groundfish fisheries. One question was asked: Would each alternative induce a different level of non-specified species

bycatch as compared to average levels of bycatch between 1997 and 1999? The reference point against which the question was assessed is the current population trajectory or harvest rate of the subject target fish species (Table 4.0-1). The criterion for evaluating significance was whether a substantial difference in bycatch amount would occur (+>50% = adverse or - > 50%=beneficial). Indirect effects include habitat disturbance by fishing gear and disruption of food web interactions by disproportionate removal of one or more trophic levels. No attempt was made to evaluate the significance of indirect effects. Insufficient information exists to estimate the indirect effects of changes in the incidental catch of non-specified species.

4.2.1 Effects of Alternatives 1 Through 5 on Non-specified Species

Bering Sea/Aleutian Islands and the Gulf of Alaska non-specified species were considered separately when enough information permitted. For Alternatives 1, 2, 3, and 4, effects are predicted to be insignificant (less than 20% change) or unknown. For Alternatives 5, no fishing, jellyfish bycatch is predicted to result in a greater than 50% reduction and other non-specified fish, sessile invertebrates and mobile invertebrates are predicted to receive significant beneficial effects. Alternatives 1 through 5 on the BSAI and GOA non-specified species are summarized in Table 5.0-1.

4.3 Effects on Forage Fish Species

In this analysis the species referred to as forage fish species are limited to those species included in FMP Amendments 36 in the BSAI and 39 in the GOA. A great many other species occupy similar trophic levels in the food chain to forage fish as species preyed upon by higher trophic levels at some period during their life history, such as juvenile pollock and Pacific cod. Management concerns, data limitations, research in progress, and planned research to address these concerns are discussed in Section 4.5 of the Draft Programmatic SEIS (NMFS, 2001a). Estimates of biomass and seasonal distribution of biomass are unavailable for forage fish species, therefore the effects of different levels of target species harvest on forage fish species cannot be quantitatively described. Direct effects include the removal of forage fish species from the environment as incidental catch in the groundfish fisheries.

4.3.1 Effects of Alternatives 1 Through 5 on Forage Fish Species

The reference point against which forage fish effects is assessed is the current population trajectory or harvest rate of the subject target fish species (Table 4.0-1). The criterion for evaluating significance is substantial difference in bycatch amount (+>50% = adverse or -> 50%= beneficial). Indirect effects would include habitat disturbance by fishing gear and disruption of food web interactions by disproportionate removal of one or more trophic levels. There is insufficient information available to estimate the indirect effects of changes in the incidental catch of forage species. Even though the amount of biomass and seasonal distribution is unknown for the individual forage fish groups, the small amount of average incidental catch in the BSAI of 39 mt and in the GOA of 61 mt (1997 to 1999) is not likely to affect stocks (abundance) of forage fish species by more than 20%. This amount is rated insignificant under all alternatives considered except smelt bycatch is predicted to have significant beneficial effects (between 20% and 50% reduction) from Alternative 5 (setting TAC at zero) in both the Bering Sea/Aleutian Islands and the Gulf of Alaska. In both the BSAI and the GOA more than 90% of the incidental catch by weight of all forage fish species is smelt taken in pollock fisheries. Alternatives 1 through 5 on the BSAI and GOA forage fish are summarized in Table 5.0-1.

4.4 Effects on Prohibited Species

Prohibited species in the groundfish fisheries include: Pacific salmon (chinook, coho, sockeye, chum, and pink), steelhead trout, Pacific halibut, Pacific herring, and Alaska king, Tanner, and snow crab. The most recent review of the status of crab stocks may be found in 2001 Crab SAFE (NPFMC, October 2001) and for the other species in Section 3.5 of the Steller Sea Lion Protection Measures SEIS (NMFS, 2001c). The effects of the groundfish fisheries in the BSAI and GOA on prohibited species are primarily managed by conservation measures developed and recommended by the Council over the entire history of the FMPs for the BSAI and GOA and implemented by federal regulation. These measures can be found at 50 CFR part 679.21 and include prohibited species catch (PSC) limitations on a year round and seasonal basis, year round and seasonal area closures, gear restrictions, and an incentive plan to reduce the incidental catch of prohibited species by individual fishing vessels. These management measures are discussed in Section 3.5 of the SSL SEIS (NMFS, 2001c) and by Witherell and Pautzke (1997).

This analysis focuses on the effects of the alternatives on four aspects of prohibited species management measures; 1) effects of PSC limitations and other management measures on the stocks of prohibited species; 2) effects of PSC limitations and other management measures on the directed fisheries for those prohibited species; 3) effects of PSC limitations and other management measures on the directed fisheries for groundfish; and 4) effects of PSC limitations and other management measures on recent levels of incidental catch in the groundfish fisheries.

Pacific salmon are managed by the State of Alaska on a sustained yield principal. Predetermined escapement goals for each salmon stock are monitored on an inseason basis to insure long term sustainable yields. When escapement levels are low commercial fishing activities are curtailed, if escapement levels exceed goals commercial fishing activities are enhanced by longer open seasons. In instances where minimum escapement goals are not met sport and subsistence fishing activities may also be curtailed. The benchmark used to determine the significance of effects under each alternative on salmon stocks was whether or not salmon escapement needs would reasonably expected to be met. If the alternative was reasonably not expected to jeopardize the capacity of the salmon stocks to produce long term sustainable yields it was deemed insignificant, if the alternative was reasonably expected to jeopardize the capacity of the salmon stocks to produce long term sustainable yields it was deemed significantly adverse, where insufficient information exists to make such conclusions the alternative's effects are unknown.

The IPHC is responsible for the conservation of Pacific halibut resource. The IPHC uses a policy of harvest management based on a constant exploitation rates. The constant exploitation rate is applied annually to the estimated exploitable biomass to determine a constant exploitation yield (CEY). The CEY is adjusted for removals that occur outside the directed hook-and-line harvest (incidental catch in the groundfish fisheries, wastage in halibut fisheries, sport harvest, and personnel use) to determine the directed hook-and-line quota. Incidental catch of halibut in the groundfish fisheries results in a decline in the standing stock biomass, a lowering of the reproductive potential of the stock, and reduced short and long term yields to the directed hook-and-line fisheries. To compensate the halibut stock for these removals over the short term halibut mortality in the groundfish fisheries is deducted on a pound for pound basis each year from the directed hook-and-line quota. Halibut incidentally taken in the groundfish fisheries are of smaller average size than those taken in the directed fishery, this results in further impacts on the long term reproductive potential of the halibut stock, this impact on average is estimated to reduce the reproductive potential of the halibut stock by 1.7 pounds for each 1 pound of halibut mortality in the groundfish fisheries. These impacts are discussed by

Sullivan *et. al.* (1994). The benchmark used to determine the significance of effects under each alternative on the halibut stock was whether or not incidental catch of halibut in the groundfish fisheries would reasonably expected to lower the total CEY of the halibut stock below the long term estimated yield of 80 million pounds. If the alternative was reasonably not expected to decrease the total CEY of the halibut stock below the long term estimated yield of 80 million pounds it was rated insignificant, if the alternative was reasonably expected to lower the total CEY of the halibut stock below the long term estimated yield of 80 million pounds it was rated significantly adverse, where insufficient information exists to make such conclusions the alternative's effects are unknown.

Pacific herring are managed by the State of Alaska on a sustained yield principal. Pacific herring are surveyed each year and the GHLs are based on an exploitation rate of 20% of the projected spawning biomass, these GHLs may be adjusted inseason based on additional survey information to insure long term sustainable yields. The ADF&G have established minimum spawning biomass thresholds for herring stocks which must be met before a commercial fishery may occur. The benchmark used to determine the significance of effects under each alternative on herring stocks was whether or minimum spawning biomass threshold levels would reasonably expected to be met. If the alternative was reasonably not expected to jeopardize the capacity of the herring stocks to reach minimum spawning biomass threshold levels it was deemed insignificant, if the alternative was reasonably expected to jeopardize the capacity of the herring stocks to reach minimum spawning biomass threshold levels it was deemed significantly adverse, where insufficient information exists to make such conclusions the alternative's effects are unknown.

Alaska king, Tanner, and snow crab stocks in the BSAI are protected by area trawl closures and PSC limitations. Minimum stock size thresholds (MSST) have been established for these crab species stocks to help prevent overfishing. The benchmark used to determine the significance of effects under each alternative on crab stocks was whether MSST levels would reasonably expected to occur. If the alternative was reasonably not expected to jeopardize the capacity of the crab stocks to maintain MSST levels it was deemed insignificant, if the alternative was reasonably expected to jeopardize the capacity of the crab stocks to reach maintain MSST levels it was deemed significantly negative, where insufficient information exists to make such conclusions the alternative's effects are unknown.

For all prohibited species if under the alternative considered the catch in the directed fisheries for those species was expected to increase or decrease by more than 20 % from 1999 levels (chosen as the benchmark year for purpose of comparison) the effect was rated significantly beneficial or adverse respectively. If under the alternative considered the catch in the directed fisheries for those species was not expected to increase or decrease by more than 20 % from 1999 levels (chosen as the benchmark year for purpose of comparison) the effect was rated insignificant as harvest levels based on stock conditions often vary over this range from year to year. If under the alternative considered insufficient information exists to estimate changes in harvest levels the effect was rated as unknown.

For all groundfish if under the alternative considered the total harvest in the directed fisheries for those species was expected to increase or decrease by more than 20 % from 1999 levels (chosen as the benchmark year for purpose of comparison) the effect was rated significantly beneficial or adverse respectively. If under the alternative considered the catch in the directed fisheries for those species was not expected to increase or decrease by more than 20 % from 1999 levels (chosen as the benchmark year for purpose of comparison) the effect was rated insignificant as harvest levels based on stock conditions often

vary over this range from year to year. If under the alternative considered insufficient information exists to estimate changes in harvest levels the effect was rated as unknown.

The establishment by the Council of annual halibut PSC limits in the directed fisheries of the GOA and the annual and seasonal apportionments thereof of all PSC limits to gear types and targets in the BSAI and GOA is of critical importance each year in both minimizing the incidental catch of prohibited species and in maximizing the optimum yield from the groundfish resources to the fishing industry. In section 4.5 of the Steller Sea Lion Protection Measures SEIS (NMFS, 2001c) the effects of alternatives to provide protection to the endangered western population Steller sea lions on prohibited species incidental catch levels in the pollock, Pacific cod, and Atka mackerel fisheries were examined using average catch for the period 1997 through 1999. The authors however noted that in the BSAI pollock fishery the 1997 and 1999 average catch of halibut and crab was not expected to continue due to additional management measures to protect prohibited species became effective in 1999. For this reason in this analysis 1999 prohibited species incidental catch and directed groundfish catch is presented for comparison to the groundfish TAC alternatives in Table 4.4-4.

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) National Standard 9 directs that when a regional council prepares and FMP they shall to the extent practicable minimize bycatch and to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. Over the years since the enactment of the MSFCMA in 1976 the Council has recommended and NMFS has implemented over 30 FMP amendments designed to help minimize the incidental catch and mortality of prohibited species. Levels of incidental catch of prohibited species in each fishery in 1999 (Table 4.4-4) were used to estimate the effects TAC levels set for each fishery on incidental catch levels of prohibited species under each alternative. It was assumed for each fishery that an increase or decrease in TAC would result in a proportional increase or decrease in incidental catch, increases were not assumed to exceed PSC limitations where applicable. For all prohibited species if under the alternative considered the incidental catch of prohibited species in the directed fisheries for groundfish was expected to increase or decrease by more than 50% from 1999 levels (chosen as the benchmark year for purpose of comparison) the effect was rated significantly beneficial or adverse respectively. If under the alternative considered the incidental catch in the directed fisheries for groundfish was not expected to increase or decrease by more than 50% from 1999 levels (chosen as the benchmark year for purpose of comparison) the effect was rated insignificant as incidental catch of prohibited species in the directed groundfish fisheries often vary over this range from year to year. If under the alternative considered insufficient information exists to estimate changes in harvest levels the effect was rated as unknown.

4.4.1 Effects of Alternative 1 on Prohibited Species and Directed Fisheries

Under Alternative 1 catch quotas would be set at the $maxF_{abc}$ level, in the GOA this would amount to 444,239 mt which falls within the optimum yield range of 116,000 mt to 800,000 however in the BSAI this would amount to 3,393,711 mt which would be constrained by the upper limit established for optimum yield of 2,000,000 mt for the BSAI (CFR § 679.20(a)). Alternative 1 sets catch quotas at the highest levels considered, even so PSC limits established for the BSAI by regulation and halibut PSC limitations recommended by the Council for the GOA in 2002 along with other factors such as market demand for the different groundfish targets will likely constrain the harvest of groundfish in both the BSAI and the GOA as in previous years. In the worst case the entire PSC limit for each prohibited species would be reached in both the BSAI and GOA, and that in the GOA for prohibited species without PSC limits, incidental catch rates

would be similar to those in 1999. For Pacific salmon these PSC numerical limits are very low compared to recent average returns and would not be expected to prevent salmon returns from reaching escapement goals. There are concerns for several chinook and chum stocks in the Bering Sea. In an analysis on the effects on salmon returns in the EA prepared for BSAI FMP Amendment 21b to reduce chinook salmon bycatch it was estimated that with the elimination of all incidental catch in the groundfish fisheries chinook salmon returns on average would increase by 4.4% in the Nushagak and by 1.7% in the Yukon Rivers, similar estimates of increases in chum salmon runs are not available. For these reasons the effect of Alternative on salmon stocks is rated insignificant. Because incidental catch of halibut in the groundfish fisheries, as well as all other removals, is accounted for in setting the directed hook-and-line fishery CEY for halibut and the total CEY for the fishery is above the estimated long term CEY of 80 million pounds, the effect of incidental catch of halibut on the halibut stock under Alternative 1 is rated insignificant. The PSC limitation for herring of 1% current biomass estimates in the BSAI and the low volume of herring bycatch in the GOA (1997 through 1999 average 15 mt (NMFS 2001c)) would not be expected to reduce herring stocks below minimum spawning biomass thresholds under Alternative 1 and the effects are rated insignificant. In the BSAI PSC limits for crab are set at a proportion of the estimated number of animals with upper limits approximately 0.5% for red king crab, 1.2% for Tanner crab, and 0.1 % for snow crab. Given these low levels, even if crab PSC limits were reached it is unlikely that any effects on crab stocks could be detected. Incidental catch of crab in the GOA is very low, in 1999 a total of 238 red king crab and 81,074 Tanner crab (Table 4.4-2). Because incidental catch is small relative to other sources of mortality, time and area closures for trawl gear in the BSAI and GOA are thought to be more effective in reducing effects on crab stocks (Witherell and Harrington, 1996) and the effect of Alternative 1 on all crab stocks in the BSAI and GOA is rated insignificant.

Due to the low numbers of salmon incidental taken in the GOA and salmon PSC limitations for chum and chinook salmon in the BSAI present levels of salmon incidental catch are not likely to effect escapement. For those western stocks of chinook salmon of concern in the EA prepared for Amendment 21b to the BSAI FMP a reduction in incidental catch of 40,000 chinook was estimated to increase commercial catches on average by 2,700 chinook in the Nushagak and 2,200 chinook in the Yukon Rivers. This amount represents 2.5% of the average commercial catch of 194,000 chinook in these drainages. Similar estimates on effects on chum salmon are not available. As an increase or decrease of less than 20% to the commercial salmon fisheries would not be expected given the reduced chinook PSC cap of 37,000 fish in the BSAI, the current PSC limit of 42,000 chum in the BSAI, and current incidental catch rates in the GOA the effect of incidental catch on the commercial catch of salmon under Alternative 1 is rated insignificant. In the 1998 assessment of Pacific halibut for the 1999 fishing year the total CEY for Alaska was 60,748 mt. If the combined halibut PSC limits in Alaska totaling 6,825 mt were reached (6,572 mt in 1999 Table 4.4-4) this would represent a reduction in the amount of the total CEY available to the directed fishery of about 12% and as such is rated insignificant. However it is worth noting that the reductions in CEY amounts for the directed commercial fishery are not proportional over all halibut management areas. The halibut CEY amount for the directed fishery in Area 4 is reduced between 20% and 50% (Clark and Parma, 2000). The halibut PSC limits are fixed, rather than floating with the condition of halibut stocks. Indirect effects of a downstream reduction in the potential yield of the halibut stock (1.7 pounds on average for each 1 pound of mortality) coupled with projected declines in the exploitable biomass in the halibut stock suggest that at some future time the effect of incidental catch of halibut in the groundfish fisheries could have an adverse effect on the directed halibut fishery in the future. Due the herring PSC limit of 1% of estimated biomass in the BSAI and the present low volume of incidental catch in the GOA and increase or decrease in the commercial catches herring would not be likely to increase or decrease by more than 20% under Alternative 1 and the effect on the commercial

herring fisheries is rated insignificant. For these same reasons floating PSC limits based on stock abundance in the BSAI and the present low numbers of animals taken in the GOA the effect of incidental catch in the groundfish fisheries along with seasonal and area closures to trawl gear on all crab stocks the effect on commercial crab fisheries is rated insignificant.

The apportionment of annual and seasonal PSC limits to the groundfish targets by gear type is of critical importance in order to optimize the harvest of groundfish within PSC limitations. Although average incidental catch of prohibited species by gear type, season, and target are extremely useful in anticipating incidental catch needs to support the harvest of or the different groundfish targets the complex interactions between the distribution of fishing effort and variation in incidental catch rates of prohibited species invariably result in grounding fishing closures due to reaching PSC limits each year. Where PSC limits can be expected to constrain the groundfish fisheries apportionments are based primarily on socioeconomic concerns. One such example is in the trawl fisheries in the GOA. During the first quarter of the year when incidental catch of halibut in the Pacific cod fishery is at its lowest a greater proportion of the annual halibut allowance is apportioned to the shallow water targets (which include Pacific cod) than at other times of the year and during the summer months when the incidental catch of halibut in the rockfish fisheries is at its lowest a greater proportion of the annual halibut allowance is apportioned to the deep water targets (which include rockfish). With such apportionments the intent is to maximize, up to TAC levels, the harvest of most valuable species.

In the BSAI although the annual 2002 PSC levels are lower from those in effect for 1999 many these levels were not reached in 1999, the exceptions were the trawl red king crab PSC limit in the RKCSS, the first seasonal apportionment of halibut for hook-and-line gear in the Pacific cod fishery, and the seasonal trawl halibut PSC limits in the yellowfin, rock sole, and other flatfish fisheries. Some of the PSC limits are likely to be reached in the BSAI in 2002 which would constrain the harvest of some groundfish targets but probably not to a greater degree in 1999. In the GOA the annual 2002 PSC limits for halibut are unchanged from 1999 levels, these levels were all reached in 1999 and are expected to in 2002 as well. Overall the total groundfish harvested in the groundfish fisheries would not be expected to increase or decrease by more than 20% from 1999 levels due to PSC limitations and the effect of Alternative 1 on groundfish harvest levels due to PSC is rated insignificant.

Assuming incidental catch rates of prohibited species in 2002 similar to 1999 levels in the BSAI and GOA (Table 4.4-4) TAC levels under Alternative 1 in combination with seasonal and fishery specific PSC apportionments, the total incidental catch of each prohibited species group would not be expected to increase or decrease by more than 50%. The effect of Alternative 1 on levels of incidental catch of prohibited species in the groundfish fisheries is therefore rated insignificant in the BSAI and GOA.

4.4.2 Effects of Alternative 2 on Prohibited Species and Directed Fisheries

Under Alternative 2 catch quotas would be set levels recommended by the Council at its December 2001 meeting. It the BSAI this would amount to 2,000,000 mt and in the GOA 414,530 mt if the Council were to adopt the GOA Plan Team recommendations for ABC levels as their recommended TAC levels. For the reasons discussed under Alternative 1 the effect of Alternative 2 on stocks of prohibited species is rated insignificant (Table 5.0-1) because PSC limits, even if reached, would not have a significant impact on stocks of prohibited species. Additionally for the reasons discussed under Alternative 1 the effects of Alternative 2 on the directed fisheries for prohibited species is rated insignificant (Table 5.0-1) because PSC limits, even if reached, would not significantly reduce the amount harvested by the directed fisheries which are permitted

to target prohibited species. Under Alternative 2 the total harvest level of groundfish in the BSAI would not be expected be reduced or increased by more than 20% from the 1999 level as result of the seasonal and fishery specific apportionment of PSC limits and is rated insignificant (Table 5.0-1) In the GOA the Council's recommended PSC limits for halibut are unchanged from 1999 levels. The Council's recommended annual PSC limits and the seasonal and fishery specific apportionments of PSC limits in the GOA would not be expected be reduced or increased by more than 20% from the 1999 level as result of the seasonal and fishery specific apportionment of PSC limits and is rated insignificant (Table 5.0-1).

In section 4.5.1.4 the SSL SEIS (NMFS 2001) the effects of the preferred alternative on the incidental catch levels of prohibited species were estimated to result in an increase of herring and other salmon incidental catch in the pollock fisheries of 16% and 7% respectively while the incidental catch of chinook salmon was estimated to result in a reduction of 9%. In the Pacific cod fisheries reductions of incidental catch of halibut (11%), Tanner crab (30%), chinook (25%) and other salmon (8%) were expected. Assuming incidental catch rates of prohibited species in 2002 similar to 1999 levels in the BSAI (Table 4.4-4) TAC levels under Alternative 2 in combination with seasonal and fishery specific PSC apportionments, the total incidental catch of each prohibited species group would not be expected to increase or decrease by more than 50%. The effect of Alternative 2 on levels of incidental catch of prohibited species in the groundfish fisheries is therefore rated insignificant in the BSAI. In section 4.5.2.4 the SSL SEIS (NMFS 2001c) the effects of the preferred alternative on the incidental catch levels of prohibited species in the GOA were estimated to range from an increase of up 15% (Tanner crab in the pollock fishery) to a decease of 11% (other salmon in the pollock fishery) for TACs set at 2000 levels. Assuming incidental catch rates of prohibited species in 2002 similar to 1999 levels in the GOA (Table 4.4-4) TAC levels under Alternative 2 in combination with seasonal and fishery specific PSC apportionments, the total incidental catch of each prohibited species group would not be expected to increase or decrease by more than 50%. The effect of Alternative 2 on levels of incidental catch of prohibited species in the groundfish fisheries is therefore rated insignificant in the GOA.

In this EA for establishing TAC levels for groundfish in the Alaskan fisheries for 2002 the authors have used the ABCs recommended by the Plan Teams for TAC. The Council however frequently recommends that TACs for several targets be set at levels below ABC. Setting TACs lower than ABC levels would not result in a change of effects on prohibited species.

4.4.4 Effects of Alternative 3 on Prohibited Species and Directed Fisheries

Under Alternative 3 catch quotas would be set at 50% of the $maxF_{abc}$ level in the BSAI this would amount to 1,843,654 mt and in the GOA 219,474 mt. For the reasons discussed under Alternative 1 the effect of Alternative 3 on stocks of prohibited species is rated insignificant (Table 5.0-1) because PSC limits, even if reached, would not have a significant impact on stocks of prohibited species. Additionally for the reasons discussed under Alternative 1 the effects of Alternative 3 on the directed fisheries for prohibited species is rated insignificant (Table 5.0-1) because PSC limits, even if reached, would not significantly reduce the amount harvested by the directed fisheries which are permitted to target prohibited species. Under Alternative 3 the total harvest level of groundfish in the BSAI would not be expected to be reduced or increased by more than 20% from the 1999 level as result of the seasonal and fishery specific apportionment of PSC limits and is rated insignificant (Table 5.0-1). In the GOA the Council's recommended PSC limits for halibut are unchanged from 1999 levels. The Council's recommended annual PSC limits and the seasonal and fishery specific apportionments of PSC limits in the GOA would not be expected to reduce or increase the harvest of groundfish by more than 20% from the 1999 level and is rated insignificant (Table 5.0-1).

Assuming incidental catch rates of prohibited species in 2002 similar to 1999 levels in the BSAI (Table 4.4-4) TAC levels under Alternative 3 in combination with seasonal and fishery specific PSC apportionments, the total incidental catch of each prohibited species group would not be expected to increase or decrease by more than 50%. The effect of Alternative 3 on levels of incidental catch of prohibited species in the groundfish fisheries is therefore rated insignificant (I) in the BSAI. In section 4.5.2.4 the SSL SEIS (NMFS 2001) the effects of the preferred alternative on the incidental catch levels of prohibited species in the GOA was estimated range from an increase of up 15% (Tanner crab in the pollock fishery) to a decease of 11% (other salmon in the pollock fishery) for TACs set at 2000 levels.

In combination with TAC recommendations, annual halibut PSC limits and seasonal and fishery specific PSC apportionments, and incidental catch rates in the different fisheries unchanged from 1999 (Table 4.4-4), the total incidental catch of each prohibited species group would not be expected to increase or decrease by more than 50%.

4.4.4 Effects of Alternative 4 on Prohibited Species and Directed Fisheries

Under Alternative 4 catch quotas would be set at levels equal the most recent 5 year average *F*, in the BSAI this would amount to 1,639,477 mt and in the GOA 212,699 mt. Alternative 4 sets TAC at levels that fall within the range of 1,400,000 to 2,000,000 mt in the BSAI and 116,000 mt to 800,000 mt in the GOA established for optimum yield. For the reasons discussed under Alternative 1 the effect of Alternative 4 on stocks of prohibited species is rated insignificant (Table 5.0-1) because PSC limits, even if reached, would not have a significant impact on stocks of prohibited species. Additionally for the discussed under Alternative 1 the effects of Alternative 4 on the directed fisheries for prohibited species is rated insignificant (Table 5.0-1) because PSC limits, even if reached, would not significantly reduce the amount harvested by the directed fisheries which are permitted to target prohibited species. Under Alternative 4 the total harvest level of groundfish in the BSAI would not be expected be reduced or increased by more than 20% from the 1999 level as result of the seasonal and fishery specific apportionment of PSC limits and is rated insignificant (Table 5.0-1). In the GOA the Council's recommended PSC limits for halibut are unchanged from 1999 levels. The Council's recommended annual PSC limits and the seasonal and fishery specific apportionments of PSC limits in the GOA would not be expected to reduce or increase total groundfish harvest by more than 20% from the 1999 level as result of the seasonal and fishery specific apportionment of PSC limits and is rated insignificant (Table 5.0-1).

In combination with TAC recommendations and seasonal and fishery specific PSC apportionments and incidental catch rates in the different fisheries unchanged from 1999 (Table 4.4-4), the total incidental catch of each prohibited species group would not be expected to increase or decrease by more than 50%. In section 4.5.2.4 the SSL SEIS (NMFS 2001) the effects of the preferred alternative on the incidental catch levels of prohibited species in the GOA was estimated range from an increase of up 15% (Tanner crab in the pollock fishery) to a decease of 11% (other salmon in the pollock fishery) for TACs set at 2000 levels. The effect of the preferred alternative on levels of incidental catch of prohibited species in the groundfish fisheries is therefore rated insignificant (Table 5.0-1) in the BSAI and GOA.

4.4.5 Effects of Alternative 5 on Prohibited Species and Directed Fisheries

Under Alternative 5 catch quotas would be set at zero, and if adopted the effect of this alternative would be to close directed fishing for groundfish for the 2002 year. The adoption of this alternative is considered unlikely as harvest levels would be set at levels below the lower limits established for optimum yield in the BSAI of 1,400,000 mt and in the GOA of 116,000 mt. Another effect of Alternative 5 would be to reduce incidental catch of prohibited species in the groundfish fisheries to zero. However for the reasons discussed under Alternative 1 even if incidental catch were reduced to zero the effect on stocks of prohibited species and harvest levels in the directed fisheries for these prohibited species would be insignificant (Table 5.0-1). A 100% reduction in harvest levels of groundfish is rated significantly adverse while a 100 % reduction in harvest levels of prohibited species in the groundfish fisheries is rated significantly positive (Table 5.0-1).

Table 4.4-1 Criteria used to estimate the significance of effects on stocks of prohibited species in the BSAI and GOA.

Effect	Significant Adverse	Insignificant	Significant Beneficial	Unknown
Incidental catch of prohibited species	Reasonably expected to jeopardize the capacity of the stock to maintain benchmark population levels	Reasonably not expected to jeopardize the capacity of the stock to maintain benchmark population levels	NA	Insufficient information available

Benchmarks: Salmon - minimum escapement goals, Pacific halibut - estimated long term CEY level, Pacific herring - minimum spawning biomass threshold, crab - minimum stock size threshold. NA: not applicable.

Table 4.4-2 Criteria used to estimate the significance of effects on of harvest levels in directed fisheries targeting stock of prohibited species in the BSAI and GOA.

Effect	Significant Adverse	Insignificant	Significant Beneficial	Unknown
Harvest levels in directed fisheries targeting catch of prohibited species	Substantial decrease in harvest levels in directed fisheries targeting prohibited species (>20%)	No substantial increase or decrease (<20%) in harvest levels in directed fisheries targeting prohibited species	Substantial increase in harvest levels in directed fisheries targeting prohibited species (>20%)	Insufficient information available

Table 4.4-3 Criteria used to estimate the significance of effects on harvest levels in directed groundfish fisheries targeting groundfish species in the BSAI and GOA.

Effect	Significant Adverse	Insignificant	Significant Beneficial	Unknown
Harvest levels in directed fisheries targeting groundfish species	Substantial decrease in harvest levels in directed fisheries targeting groundfish species (>20%)	No substantial increase or decrease (<20%) in harvest levels in directed fisheries targeting groundfish species	Substantial increase in harvest levels in directed fisheries targeting groundfish species (>20%)	Insufficient information available

Table 4.4-4 Catch of Groundfish and Prohibited Species in the Groundfish Fisheries in the BSAI and GOA in 1999 by Target, Area, and Gear Type. (Source: NMFS, 1999 Blend Data).

Groundfish and Prohibited Species Catch by Trawl Gear in the BSAI.

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of Bairdi Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Atka mackerel	61,769	149	559	0	50	505
Pacific cod	86,441	1,364	120,360	7,941	2,205	33
Other flatfish	2,761	50	15,496	34	107	2
Flathead sole	31,340	373	172,520	68	4	285
Rock sole	27,264	427	130,315	62,456	177	439
Greenland turbot	1,980	19	1,049	0	0	0
Arrowtooth	1,136	47	554	0	0	0
Yellowfin sole	102,067	865	437,913	76,644	0	412
Rockfish	13,530	52	0	0	0	0
Pollock (bottom)	8,716	52	1,319	91	47	24
Pollock (midwater)	849,007	72	1,078	0	10,331	44,587
Non-retained Groundfish	1,291	0	1,510	0	0	9
Total	1,187,302	3,470	882,673	147,234	12,921	46,296

Groundfish and prohibited Species Catch by Trawl Gear in the BSAI (continued)

Target	Total Catch[1] (mt)	Numbers of Snow crab[2]	Herring (mt)
Rock sole and other flatfish	61,365	256,443	2
Pacific cod	86,441	22,390	1
Pollock, Atka mackerel, and other species	920,783	1,370	804
Yellowfin sole	102,067	378,964	88
Rockfish	13,530	0	0
Greenland turbot, sablefish, and arrowtooth	3,116	0	1
Total	1,187,302	659,167	896

Groundfish and Prohibited Species Catch by Hook-and-Line Gear in the BSAI.

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of Bairdi Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	92,266	500	2,842	7,924	4	0
Greenland turbot	4,880	81	7	6	0	24
Sablefish	1,405	Not Available	0	2	0	6
Rockfish	25	1	0	0	0	0
Other species	3	0	0	0	0	0
Arrowtooth	1	0	0	0	0	0
Non-retained groundfish	2	0	0	0	0	0
Total	95,582	582	2,849	7,932	4	30

Groundfish and Prohibited Species Catch by Pot Gear in the BSAI.

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of Bairdi Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	17,031	3	40,564	978	0	0
Sablefish	32	0	0	0	0	0
Greenland turbot	31	1	0	0	0	0
Other species	1	0	0	0	0	0
Total	17,095	4	40,564	978	0	0

Total Groundfish and Prohibited Species Catch by All Gear Types in the BSAI.

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of Bairdi Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
All	1,302,979	4,056	926,086	156,144	12,925	46,326

Groundfish and Prohibited Species Catch by Trawl Gear in the GOA.

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of Bairdi Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	41,129	1,235	22,518	0	1,537	94
Deep water flatfish	3,872	140	2,225	0	16	5
Rex sole	8,313	244	1,414	0	1,854	322
Shallow water flatfish	1,447	54	967	1	3	1
Arrowtooth	3,954	130	2,194	0	157	102
Rockfish	22,101	303	557	231	572	1,529
Other species	822	6	0	0	33	0
Sablefish	16	0	0	0	0	0
Pollock (bottom)	3,644	10	72	0	1920	200
Pollock (midwater)	93,024	15	0	0	24,507	1,845
Total	178,322	2,137	29,947	232	30,599	4,098

Groundfish and Prohibited Species Catch by Hook-and-Line Gear in the GOA.

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of Bairdi Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	13,981	342	0	53	0	0
Rockfish	467	4	0	0	0	0
Other species	67	2	4	0	0	0
Deep water flatfish	2	0	0	0	0	0
Total[4]	14,517	348	4	53	0	0

Groundfish and Prohibited Species Catch by Pot Gear in the GOA.

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of Bairdi Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	19,265	41	51,123	3	0	0
Other species	31	0	0	0	0	0
Arrowtooth	12	0	0	0	0	0
Total	19,308	41	51,123	3	0	0

Total Groundfish and Prohibited Species Catch by All Gear Types in the GOA.

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of Bairdi Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
All	212,147	2,526	81,074	288	30,599	4,098

Notes:

1 Total catch includes all groundfish harvested, the targeted species as well as incidental catch of all other groundfish.

2 Numbers are estimates of individual animals and include estimates (in the case of crab) all animals, male and female, juvenile and adult, and should not be interpreted as an estimate of legal sized males that are targeted in directed crab fisheries.

3 Other salmon numbers include pink, chum, coho, and red salmon.

4 The total catch for hook-and-line gear in the GOA does not include catch in the sablefish fishery as estimates of prohibited species catch is not available.

Table 4.4-5 Criteria used to estimate the significance of effects on harvest levels in directed groundfish fisheries targeting groundfish species in the BSAI and GOA.

Effect	Significantly Adverse	Insignificant	Significant Beneficial	Unknown
Harvest levels of prohibited species in directed fisheries targeting groundfish species	Substantial decrease in harvest levels of prohibited species in directed fisheries targeting groundfish species (>50%)	No substantial increase or decrease (<50%) in harvest levels of prohibited species in directed fisheries targeting groundfish species	Substantial increase in harvest levels of prohibited species in directed fisheries targeting groundfish species (>50%)	Insufficient information available

4.5 Effects on Marine Mammals

Marine mammals were considered in groups that include: Steller sea lions, ESA listed great whales, other cetaceans, northern fur seals, harbor seals, other pinnipeds, and sea otters. Direct and indirect interactions between marine mammals and groundfish harvest occur due to overlap in the size and species of groundfish harvested in the fisheries that are also important marine mammal prey, and due to temporal and spatial overlap in marine mammal foraging and commercial fishing activities.
Impacts of the various proposed 2002 harvest levels are analyzed by addressing four core questions modified from Lowry (1982):

1. Do the proposed harvest levels result in increases in direct interactions with marine mammals (incidental take and entanglement in marine debris)?
2. Do the proposed harvest levels remove prey species at levels that could compromise foraging success of marine mammals (harvest of prey species)?
3. Do the proposed harvest levels result in temporal or spatial concentration of fishing effort in areas used for foraging by marine mammals (spatial and temporal concentration of removals with some likelihood of localized depletion)?
4. Do the proposed harvest levels modify marine mammal foraging behavior to the extent that population level impacts could occur (disturbance)?

The reference point for determining significant impact to marine mammals is predicting whether the proposed harvest levels will impact the current population trajectory of any marine mammal species. Criteria for determining significance are contained in Table 4.0-1 Significance ratings for each question are summarized in Table 4.5-1.

4.5.1 Effects of Alternatives 1 through 5 on Marine Mammals

Direct Effects - Incidental Take/Entanglement in Marine Debris

Annual levels of incidental mortality are estimated by comparing the ratio of observed incidental take of dead animals to observed groundfish catch (stratified by area and gear type). Incidental bycatch frequencies also reflect locations where fishing effort is highest. In the Aleutian Islands and GOA, incidental takes are often within Steller sea lion critical habitat. In the Bering Sea takes are farther off shore and along the continental shelf. Otherwise there seems to be no apparent “hot spot” of incidental catch disproportionate with fishing effort. It is, therefore, appropriate to estimate catch ratios based on estimated TAC. The projected level of take under all proposed TAC alternatives is below that which would have an effect on marine mammal population trajectories Therefore, incidental bycatch frequencies are determined to be insignificant under all alternatives proposed.

Indirect Effects - Spatial and Temporal Concentration of Fishery

Spatial and temporal concentration effects by these fisheries have just been analyzed and modified to comply with Endangered Species Act considerations for Steller sea lions (NMFS 2001b). The criteria for insignificant effect determination is based on the assumption of the Steller sea lion protection measures analysis and section 7 biological opinion that the fishery as modified by SSL Protection Measures mitigates the impacts (Table 5.0-1). That determination applies to all marine mammal species in these management areas.

Indirect Effects - Disturbance Effects

Vessel traffic, nets moving through the water column, or underwater sound production may all represent perturbations, which could affect marine mammal foraging behavior. Foraging could potentially be affected not only by interactions between vessel and species, but also by changes in fish schooling behavior, distributions, or densities in response to harvesting activities. In other words, disturbance to the prey base may be as relevant a consideration as disturbance to the predator itself. For the purposes of this analysis, we recognize that some level of prey disturbance may occur as a fisheries effect. The impact on marine mammals using those schools for prey is a function of both the amount of fishing activity and its concentration in space and time, neither of which may be extreme enough under any alternative to represent population level concerns. To the extent that fishery management measures do impose limits on fishing activities inside critical habitat, we assume at least some protection is provided from these disturbance effects. The criterion set for insignificant impacts is a similar level of disturbance as that which was occurring in 2001. Thus, the effect under all alternatives is insignificant according to the criteria set for significance (Table 4.5-1).

Because of the recent change in Northern sea otter status it is being mentioned individually. Norther sea otters were designated by the US Fish and Wildlife Service (FWS) as candidate species under the ESA on August 22, 2000, in the Aleutian Islands (from Unimak Pass to Attu Island) (65 FR 67343). Funding has not been available to develop proposed rule making for listing the sea otter under the ESA. On August 21, 2001, the FWS was petitioned under the Marine Mammal Protection Act (MMPA) for the Alaska stock of sea otters to be listed as depleted. On November 2, 2001 (66 FR 55693), the FWS determined that the current population of sea otters throughout Alaska exceeds the optimum sustainable population of 60,000 animals and, therefore, does not meet the criteria to be listed as depleted under the MMPA. The FWS is continuing to evaluate the sea otter under both the ESA and MMPA. As far as interaction with the groundfish fisheries, NMFS observers monitored incidental take in the 1990–1995 groundfish trawl, longline, and pot fisheries. No mortality or serious injuries to sea otters were observed. All alternatives for setting 2002 TAC specifications will have insignificant impacts northern sea otter.

Table 4.5-1 Criteria for determining significance of effects to marine mammals.

Effects	Significance Criteria			
	Significant Adverse	Insignificant	Significant Beneficial	Unknown
Incidental take/ entanglement in marine debris	Take rate increases by >25%	Level of take below that which would have an effect on population trajectories	Not Applicable	Insufficient information available on take rates
Spatial/ temporal concentration of fishery	More temporal and spatial concentration in key areas	Spatial concentration of fishery as modified by SSL Protection Measures	Much less temporal and spatial concentration of fishery in all key areas	Insufficient information as to what constitutes a key area
Disturbance	More disturbance (closed areas reopened)	Similar level of disturbance as that which was occurring in 2001	Not Applicable	Insufficient information as to what constitutes disturbance

4.6 Effects on Seabirds

The five alternatives in this EA set the catch quota, by target species and region, equal to variably defined levels of fishing mortality rates used to set the ABC. Alternative 5 sets harvest equal to zero, and is considered the no action alternative. Impacts of fishery management on seabirds are difficult to predict due to the lack of information for many aspects of seabird ecology. A summary of incomplete and unknown information was presented in the Draft Programmatic SEIS, (Section 4.3.1) and was followed by a description of the current management regime at that time (Section 4.3.2) and then by an analysis of the effects of the Draft Programmatic SEIS alternatives on seabirds (Section 4.3.3) (NMFS, 2001a).

Seabird Groups and Effects to Consider: Given the sparse information, it is not likely that the fishery effects on most individual bird species are discernable. For reasons explained in the Steller Sea Lion Protection Measures SEIS (NMFS 2001c), the following species or species groups are considered: northern fulmar, short-tailed albatross, spectacled eider, and Steller's eiders, albatrosses and shearwaters, piscivorous seabird species, and all other seabird species not already listed. The fishery effects that may impact seabirds are direct effects of incidental take (in gear and vessel strikes), and indirect effects on prey (forage fish) abundance and availability, benthic habitat, processing waste and offal.

Direct Effects - Incidental take The effects of incidental take of seabirds (from fishing gear and vessel strikes) are described in Section 4.3.3 of the Draft Programmatic SEIS (NMFS, 2001a). Birds are taken incidentally in longline, trawl, and pot gear, although the vast majority of that take occurs in the longline fisheries and is comprised primarily of the following species or species groups: fulmars, gulls, shearwaters, and albatrosses. Therefore, this analysis of incidental take focuses primarily on the longline fisheries and those species.

As noted in Section 4.3.3.1 of the Draft Programmatic SEIS (NMFS, 2001a), several factors are likely to affect the risk of seabird incidental catch. It is reasonable to assume that risk goes up or down, partly as a consequence of fishing effort (measured as total number of hooks) each year (NMFS 2001a). But, if seabird avoidance measures used to prevent birds from accessing baited hooks are effective, then effort levels would probably be less of a critical factor in the probability of a bird getting hooked. Seabird bycatch avoidance measures are outlined on page 4.3-8 of the Draft Programmatic SEIS (NMFS, 2001a).

Indirect Effects - Prey (forage fish) abundance and availability A description of the effects of prey abundance and availability on seabirds is in Section 4.3.3 of the Draft Programmatic SEIS (NMFS, 2001a). Detailed conclusions or predictions cannot be made, however, the present understanding is fisheries management measures affecting abundance and availability of forage fish or other prey species could affect seabird populations (NMFS, 2001a; NMFS, 2001c).

Indirect Effects - Benthic habitat The indirect fishery effect on benthic habitat as utilized by seabirds are described in Section 4.3.3.1 of the Draft Programmatic SEIS (NMFS, 2001a). The seabird species most likely to be impacted by any indirect gear effects on the benthos would be diving sea ducks such as eiders and scoters as well as cormorants and guillemots (NMFS, 2001c). Bottom trawl gear has the greatest potential to indirectly affect seabirds via their habitat. Thus, the remainder of this analysis will be limited to the impacts of bottom trawl gear on foraging habitat.

Indirect Effects - Processing waste and offal The volume of offal and processing wastes probably changes approximately in proportion to the total catch in the fishery. Whereas some bird populations may benefit from the food supply provided by offal and processing waste, the material also acts as an attractant that may lead to increased incidental take of some seabird species (NMFS 2001c). TAC level under various alternatives could reduce the amount of processing waste and offal that is available to scavenging seabirds, particularly in some areas near major breeding colonies. This impact would need to be considered in the balance of the beneficial and detrimental impacts of the disposal actions.

Criteria used to determine significance of effects on seabirds Significance of impacts is determined by considering the context in which the action will occur and the intensity of the action. When complete information is not available to reach a strong conclusion regarding impacts, the rating of 'unknown' is used. Table 4.6-1 outlines the qualitative significance criteria or thresholds that are used for determining if an effect has the potential to create a significant impact on seabirds.

4.6.1 Effects of Alternative 1 on Seabirds

Direct Effects - Incidental take In as much as Alternative 1 could increase fishing effort by setting the quota for harvest to $max F_{ABC}$, it has the potential to increase interactions with those seabird species prone to incidental bycatch. The Draft Programmatic SEIS (NMFS, 2001a) concluded that northern fulmars were the only species showing a positive linear relationship between fishing effort and numbers of birds hooked. This relationship did not exist for other bird groups. The short-tailed albatross, because of its small population and endangered species status, and the black-footed albatross, because of concerns of a population decline and high incidental take in the GOA, might also be affected by greater fishing effort (NMFS 2001c). These three species, the northern fulmar, short-tailed albatross, and black-footed albatross, may demonstrate conditionally significant negative effects from incidental take resulting from this alternative. However, because there is insufficient information to document a link between colonies or population trends and incidental take of these species, the effect was rated 'unknown'. The Steller Sea Lion Protection Measures SEIS (NMFS 2001c) examines the population trends and potential for effects of groundfish fisheries on these potentially affected species. Effort should be made to gather data and conduct analysis and modeling necessary to make a determination in future EA on TAC alternatives on these three species.

Indirect Effects - Prey (forage fish) abundance and availability The Draft Programmatic SEIS concluded that fishery influences on the abundance and availability of forage fish was considered insignificant for populations of northern fulmars and most other seabird groups (NMFS, 2001a). The prey base for some piscivorous seabirds, however, could be affected by localized increases in TAC level (NMFS 2001c). The effect at the population level of high TAC for these seabird species remains unknown.

Indirect Effects - Benthic habitat Increased disturbance of the benthic habitat could potentially affect those seabirds that are primarily benthic feeders, including the eiders. The eider's dependence on benthic crustacea, which could be affected by greater trawling effort, could result in a conditionally significant negative affect on eiders. However, spatial overlap between fisheries and eider forage areas are limited, and the population level effects are unknown. Other seabirds that also utilize demersal fish or small invertebrates and crustacea include cormorants and guillemots. These latter seabird groups are generalists and can utilize a variety of other fish species, thus the application of Alternative 1 is not likely to affect populations greater than current standards.

Indirect Effects - Processing waste and offal It could be that the northern fulmar, a species known to benefit from fishery discards in the North Atlantic, experiences a benefit from North Pacific fisheries. Given the unknown effect of incidental take on northern fulmars in the BSAI and on the Pribilof Island colonies in particular, any benefit from a supplemental feeding source could be reduced by the bycatch effects associated with the fishery. Based on this information, the availability of fishery processing wastes could have a conditionally significant beneficial effect on northern fulmars under Alternative 1. It is not possible at this time to determine if this effect is significant, and thus the effect is unknown.

4.6.2 Effects of Alternative 2 on Seabirds

Direct Effects - Incidental take TAC levels under Alternative 2 are identical to those of Alternative 1 in the BSAI. In the GOA, TAC levels under Alternative 2 are equivalent to those of Alternative 1 for most species, with the exceptions of a lower TAC on Pollock, Pacific cod, and Sablefish. The promulgation of Alternative 2 is thus seen as similar in effect on seabirds as those in Alternative 1. Because the primary fisheries potentially affecting seabirds in the GOA would have lower effort, it is possible that lower incidental take could occur for species such as fulmars, albatrosses and shearwaters. The population level differences are not likely to be different than those determined under Alternative 1.

Indirect Effects - Prey (forage fish) abundance and availability The effects on seabird prey from TAC levels under Alternative 2 are not likely different than those under Alternative 1, at the population level. It is possible that in the GOA, localized impacts on the seabird prey could be reduced, but the effect at the population level is considered insignificant, or for piscivorous birds, unknown.

Indirect Effects - Benthic habitat For benthic feeders, the impact of Alternative 2 on eiders is unknown, and for remaining seabirds, is considered insignificant.

Indirect Effects - Processing waste and offal TAC levels under Alternative 2 could have effects similar to those described under Alternative 1. In the GOA, processing waste and offal that is available to scavenging seabirds might be reduced. This indirect effect potentially has both beneficial and detrimental impacts and overall could be considered insignificant at the population level for all seabird species with high interaction levels with the fisheries, such as fulmars, albatrosses, shearwaters, and gulls.

4.6.3 Effects of Alternative 3 on Seabirds

Direct Effects - Incidental take Potentially, the overlap between longline vessels and fulmars foraging near colonies would be reduced under TAC levels of Alternative 3,and could result in reduced levels of interaction and incidental take of fulmars. Given the current levels of incidental take, the existing measures in place to reduce incidental take of seabirds, and all of the above considerations (see also NMFS 2001c), Alternative 3 is considered to have an unknown effect on fulmars at the BSAI colonies Black-footed albatrosses could be affected in the GOA by lower encounter rates under a $F_{50\%}$., thus the effect of this alternative on incidental take for albatrosses is considered unknown. Other seabird species are not likely to be affected significantly by this amount of change in fishing effort.

Indirect Effects - Prey (forage fish) abundance and availability For the reasons noted in the Draft Programmatic SEIS and summarized in NMFS 2001c, the potential indirect fishery effects on prey abundance and availability of Alternative 3 are considered insignificant or unknown for all seabirds. For most piscivorous

seabirds, the effects of fishing effort under this alternative would not likely be different than under current TAC levels. Those seabirds that feed closer to shore or include benthic prey in their diets, such as guillemots, cormorants, eiders and other seaducks, might benefit from lower fishing effort under this alternative. However, the potential for effects at the population or colony level are unknown, and thus effects for these groups of birds is considered unknown.

Indirect Effects - Benthic habitat A reduction of fishing effort could have a localized beneficial affect on some benthic habitats, but the level of reduction and areas affected are not likely to alter current population trends of seabirds. A possible exception are the exclusively benthic feeders, such as eiders and other seaducks, and thus the affect for this species group is unknown.

Indirect Effects - Processing waste and offal The availability of fishery processing wastes could decline under Alternative 3, which could reduce supplemental food available to fulmars, which are closely associated with fishing vessels. However, the change in fishing effort is not likely to be sufficiently different from current TAC levels to affect population-level changes in fulmars. Furthermore, reduced fishing could also have the effect of reducing interactions subjecting the birds to incidental take, thus the effects are considered unknown for fulmars.

4.6.4 Effects of Alternative 4 on Seabirds

Direct Effects - Incidental take Under Alternative 4, fishing effort varies among target species and regions, with respect to effort under Alternatives 1-3. It is thus difficult to make a determination about the potential effects of this alternative on seabirds. In general, using the 5-year average to set TAC levels is lower than other alternatives (with the exception of Alternative 5, no take). However, important exceptions are the pollock and Pacific cod fisheries in the GOA, which under Alternative 4 are equivalent to those of Alternative 1, the $max F_{ABC}$. Given the current levels of incidental take, the existing measures in place to reduce incidental take of seabirds, and all of the above considerations, Alternative 4 is considered to have an unknown effect on fulmars, albatrosses and shearwaters. See NMFS 2001c for the analysis of the effect of incidental take on these species.

Indirect Effects - Prey (forage fish) abundance and availability For the reasons noted in the Draft Programmatic SEIS and summarized in NMFS 2001c, the potential indirect fishery effects on prey abundance and availability resulting from Alternative 4 are considered insignificant or unknown at the population level for all seabirds.

Indirect Effects - Benthic habitat The promulgation of fisheries under Alternative 4 could result in high fishing pressure in the pollock fishery in the GOA, thus potentially affecting benthic habitats. The population level effects of this level of fishing effort are unknown for those birds most dependent on benthic habitats, such as eiders and other seaducks.

Indirect Effects - Processing waste and offal This alternative has the potential of increasing offal in the GOA, and thus could affect fulmars in particular. However, the population or colony effects of TAC levels under Alternative4 are unknown for fulmars, and are likely to be insignificant for other seabirds.

4.6.5 Effects of Alternative 5 on Seabirds

Direct Effects - Incidental take The effects of Alternative 5 with respect to incidental take are expected to benefit seabirds subject to incidental take in groundfish fisheries, since it eliminates or greatly reduces fishing effort. Thus, this alternative could have a conditionally significant positive effect on populations of fulmars, albatrosses, shearwaters, and gulls. Northern fulmars have considerable overlap between longline fisheries and colony location and distribution at sea (Appendix C Ecosystem Considerations, p. 109). Fulmars also demonstrate a direct link between fishing effort and incidental take rates (NMFS 2001a). For these reasons, a complete absence of fishing has high potential to have a significant beneficial effect on specific colonies. Similarly, short-tailed albatrosses and black-footed albatrosses should derive significant benefits by reduced incidental take. Other species, though incidental catch rates would be reduced, are not likely to be affected at the population or colony level.

Indirect Effects - Prey (forage fish) abundance and availability For the reasons noted in the Draft Programmatic SEIS and summarized in NMFS 2001c, the potential indirect fishery effects on prey abundance and availability of Alternative 5 are considered insignificant at the population level for most seabirds, and unknown for eiders and other seaducks.

Indirect Effects - Benthic habitat Seabirds dependent on the benthic habitat, such as eiders and other seaducks, could potentially benefit from lack of fishing under Alternative 5. Because the population level effects of this action remain unknown, the effects of this alternative on eiders and seaducks is unknown.

Indirect Effects - Processing waste and offal Based on the assumptions noted in NMFS 2001c, the availability of fishery processing wastes could have a conditionally significant beneficial effect on northern fulmars, thus, a complete reduction of fishing could reduce offal availability to fulmars. Similar effects might occur for albatrosses, shearwaters, and gulls. The degree to which these populations are dependent on offal are not known, and thus the effect is considered unknown for fulmars, albatrosses, shearwaters, and gulls, and is insignificant for other seabird species.

Table 4.6-1 Criteria used to determine significance of effects on seabirds.

Effects	Rating		
	Significant	Insignificant	Unknown
Incidental take	Take number and/or rate increases or decreases substantially and impacts at the population or colony level.	Take number and/or rate is the same.	Take number and/or rate is not known.
Prey (forage fish) availability	Prey availability is substantially reduced or increased and causes impacts at the population or colony level.	Prey availability is the same.	Changes to prey availability are not known.
Benthic habitat	Impact to benthic habitat is substantially increased or decreased and impacts at the population or within critical habitat.	Impact to benthic habitat is the same.	Impact to benthic habitat is not known.
Processing waste and offal	Availability of processing wastes is substantially decreased or increased and impacts at the population or colony level.	Availability of processing wastes is the same.	Changes in availability of processing wastes is not known.

4.7 Effects on Marine Benthic Habitat

This analysis focuses on the effects of fishing at the alternative TAC levels on benthic habitat important to commercial fish species and their prey. The analysis also provides the information necessary for an EFH (Essential Fish Habitat) assessment, which is required by the Magnuson-Stevens Act for any action that may adversely affect EFH. Two issues of concern with respect to EFH effects are the potential for damage or removal of fragile biota that are used by fish as habitat, the potential reduction of habitat complexity, which depends on the structural components of the living and nonliving substrate; and potential reduction in benthic diversity from long-lasting changes to the species mix.

Each alternative is rated as to whether it may have significant effects according to the following criteria, which are grouped into five categories:

1. Removal of or damage to Habitat Areas of Particular Concern (HAPC) biota by fishing gear
2. Modification of nonliving substrate, and/or damage to small epifauna and infauna by fishing gear
3. Change in benthic biodiversity

The reference point against which the criteria are applied is the current size and quality of marine benthic habitat and other essential fish habitat.

Consultation on effects to Essential Fish Habitat: Except for setting TAC at zero (Alternative 5), all of the alternatives have the potential for benthic disturbances that could result in regional adverse effects on EFH,

or to a component of EFH such as certain HAPC biota. In previous EFH consultations such as on the 2000 TAC specifications and the Steller Sea Lion Protection Measures (NMFS 2000, NMFS 2001e), comments with respect to mitigation have been to the effect that the Council has taken numerous actions to protect vulnerable areas, or to protect sensitive life stages of species by curtailing fishing at different times and in different areas. Given that mitigation measures to minimize effects on EFH have been undertaken through ongoing fishery management measures whose principal goal was to protect and rebuild groundfish stocks but whose results have also resulted in a benefit to habitat for all managed species, the NMFS Habitat Conservation Division stated that it believes that any potential significant adverse effects by this Federal action (groundfish fishing) have been minimized to the extent practicable. None of the TAC levels that would be specified under these alternatives would have impacts beyond those displayed in previous analyses of the effects of these groundfish fisheries on marine benthic habitat, therefore, ratings of insignificant are made for 2002 proposed TAC specifications. Regardless, a consultation on essential fish habitat for the preferred alternative will be completed and available prior to publication of the 2002 TAC specifications.

4.8 Effects on the Ecosystem

Indicators of ecosystem function are summarized in Table 4.8-1. Background information specific to the North Pacific ecosystem is contained in the ecosystem consideration section of this document (Appendix C).

Table 4.8-1 Indicators of ecosystem function.

	OBSERVATION	INTERPRETATION
Physical oceanography		
North Pacific Index	Sea level pressure averaged for Jan.-Feb, Near neutral slightly negative for the last few years	No major atmospheric support for the PDO shift
Arctic Oscillation Index	Shift to negative	When negative it supports a stronger Aleutian low, helps drive a positive PDO pattern
Pacific Decadal Oscillation (PDO)	Cool coastal pattern in GOA since 1998	Indicates shift in PDO to neutral or negative phase and inhibited productivity
GOA Temperature Anomaly	1deg less negative than May 2000	2001 not as cold as 2000
EBS summer temperature	Bottom temperatures were generally warmer and surface temperatures were colder than average	No marked changes in fish distribution were noted
GOA summer temperature	Bottom temperatures in 2001 appeared above average	Bottom temperature at depths 50-150 did not track PDO trend this year
EBS sea ice extent	Strong southerly winds kept sea ice northward of 60N	Low ice year, kept middle shelf bottom temperatures warmer

	OBSERVATION	INTERPRETATION
Papa Trajectory Index	Surface water circulation in the eastern Gulf of Alaska still appears to be in the northward mode	Stronger northerly drift pattern of Subarctic current
Habitat		
Groundfish bottom trawling effort in GOA	Bottom trawl time in 2000 was similar to 1998-99 and lower than 1990-1997	Less trawling on bottom
Groundfish bottom trawling effort in EBS	Bottom trawl time increased in 2000 relative to 1999	More trawling on bottom though still less than 1991-98
Groundfish bottom trawling effort in AI	Slightly lower in 2000, generally decreasing trend since 1990	Less trawling on bottom
Area closed to trawling	More area closed in 2000 compared with 1999	Less trawling on bottom in certain areas though may concentrate trawling in other areas
HAPC biota bycatch by all gears	Estimated at 560 t for BSAI and 32 t for GOA in 2000	Lower in BSAI than 1997-98, about constant in GOA since 1997
Target Groundfish		
Total biomass EBS/AI	Total about same in 2000 as in 1999, pollock dominant	Relatively high total biomass since around 1981
Total catch EBS	Total catch about same in 2000 as in 1999, pollock dominant	Catch biomass about same from 1984-2000
Total catch AI	Total catch declining since about 1996, Atka mackerel dominant	Total catch returning to lower levels
Total biomass GOA	Declining abundance since 1982, arrowtooth dominant	Relatively low total biomass compared to peak in 1982
Total catch GOA	Total catch lower in 2000 than 1999	Total catch similar from 1985-present
Groundfish discards	Slightly increasing rates in 2000 relative to 1999 but still lower than 1997	Slightly more target species discarding, may not be significantly different from 1999
GOA recruitment	Groundfish recruitment in 1990s is mostly below average for age structured stocks, except POP	Groundfish recruitment is low in 1990's

EBS recruitment	Some above average recruitment in early 1990s, mostly below average	Groundfish recruitment is low in mid-late 1990's
Groundfish fleet	Total number of vessels increased in 2000 relative to 1999 (121 were H&L, 43 pot, 8 trawl)	More groundfish fishing vessels
Forage		
Forage bycatch EBS	72 t in 2000,32-49t in 97-99, mostly smelts	Higher smelt catch rates in 2000
Forage bycatch GOA	125 t in 2000, higher than 1999 (30t) but similar to 1998, mostly smelts	Higher smelt catch rates in 2000
Age-0 walleye pollock EBS	Index area counts were high in 2001 but juveniles were smaller	Higher abundance around the Pribilofs, uncertain survival
Other species		
Spiny dogfish	Observer bycatch rates show mixed trends by area in GOA	Both increasing and decreasing catch rates observed over time by area
Spiny dogfish	IPHC bycatch rates since 97 show peaks in 1998 but declines since then	Possible distribution changes caused peaks in 1998
Sleeper shark	Mixed trends by area (Observer, IPHC, ADF&G)	Stable or slight increase in most areas, large increases noted in Kodiak region
Salmon shark	Highest bycatch rates in Kodiak region	Similar catch rates in recent years
EBS jellyfish	Large increases in 2000 relative to 1999, biomass increased since 1990	High jellyfish biomass
ADF&G large mesh inshore-GOA	2001 catch rates of Tanner crab are increasing, flathead sole pollock and cod are higher than prior to the regime shift	Increasing Tanner crab, other species slightly increasing last 4-5 years
Prohibited species bycatch	Halibut mortality, herring , other kind crab, chinook salmon bycatch decreased in 2000, Bairdi, opilio, other salmon increased in 2000	Prohibited species bycatch rates are mixed
Other species bycatch	Other species bycatch was higher in 2000 relative to 1999 but similar to 1997-98 rates	Dominant species in catch were skates and sculpins

Non-specified species bycatch	Non specified species bycatch was higher in 2000 relative to 1999 but was similar to 1997 rate	Dominant species in non specified bycatch were jellyfish, grenadier, and starfish
INDICATOR	**OBSERVATION**	**INTERPRETATION**
Marine mammals		
Alaskan western stock Steller sea lion pup counts	Average annual decrease in the western stock of about 8%/year since 1990	Continued decline in pup portion of the population
Alaskan western stock Steller sea lion counts	2000 non-pup counts were lower than 1998	Continued decline in non-pup portion of population
Alaskan eastern stock Steller sea lion counts	Overall increase from 1991-2000 was 1.7% per year	Stable or slightly increasing
Northern fur seal pup counts	Non significant decline on St Paul from 1999 to 2000, significant decline on St. George from 1999 to 2000	Overall statistically significant, but small decline in combined counts of St. Paul and St. George since 1990
Seabirds	Seabird breeding chronology	
Seabird productivity	Overall seabird productivity was average or above average in 2000	Average or above average chick production
Population trends	Mixed: 12 increased, 7 showed no change, 8 decreased	Variable depending on species and site
Seabird bycatch	99 BSAI longline bycatch is lower than 98, N. fulmar dominate the catch (GOA longline bycatch is small and relatively constant) Trawl bycatch rates are variable and perhaps increasing	Unclear relationship between bycatch and colony population trends
Aggregate indicators	Regime shift scores	
Trophic level catch EBS and AI	Constant, relatively high trophic level of catch since 1960s	Not fishing down the food web
Trophic level catch GOA	Constant, relatively high trophic level of catch since 1970s	Not fishing down the food web

4.9 Effects on State of Alaska Managed Fisheries

Assessing the effects of each alternative on State of Alaska managed fisheries was accomplished by analyzing five state managed waters (Prince William Sound, Cook Inlet, Kodiak, Chignik, and South Peninsula) and asking if each alternative would have an effect on the harvest levels of state managed Pacific cod fisheries and Prince William Sound pollock fisheries, and the parallel Pacific cod fisheries that occur within state waters during the open federal season.

The guideline harvest level of pollock to be taken inside Prince William Sound in the State pollock fishery is deducted from the GOA pollock TAC to get the amount for the federal groundfish fishery.

4.10 Social and Economic Consequences

4.10.1 Description of the Fishery

As noted earlier in the EA, detailed descriptions of the social and economic backgrounds of the groundfish fisheries may be found in the following reports:

Alaska Groundfish Fisheries. Draft Programmatic Supplemental Environmental Impact Statement (NMFS, 2001a). This report contains detailed fishery descriptions and statistics in Section 3.10, "Social and Economic Conditions," and in Appendix I, "Sector and Regional Profiles of the North Pacific Groundfish Fisheries."

"Economic Status of the Groundfish Fisheries off Alaska, 2000" (Hiatt, Felthoven and Terry, 2001), also known as the "2001 Economic SAFE Report." This document is produced by NMFS and updated annually. The 2001 edition contains 49 historical tables summarizing a wide range of fishery information through the year 2000.

Steller Sea Lion Protection Measures Draft Supplemental Environmental Impact Statement (NMFS, 2001b. Referred to as "SSL SEIS" in the remainder of this section) contains several sections with useful background information on the groundfish fishery (although the majority of information provided is focused on three important species - pollock, Pacific cod, and Atka mackerel). Section 3.12.2 provides extensive background information on existing social institutions, patterns, and conditions in these fisheries and associated communities, Appendix C provides extensive information on fishery economics, and Appendix D provides extensive background information on groundfish markets.

Draft Environmental Impact Statement for American Fisheries Act Amendments 61/61/13/8 (NMFS 2001c) provides a survey of the Bering Sea and Aleutian Islands groundfish fishery paying particular attention to the pollock fishery and the management changes introduced into it following the American Fisheries Act. The information is contained in Section 3.3, "Features of the human environment."

General significance of the groundfish fisheries off of Alaska

In 2000, the most recent year covered by the Groundfish Economic SAFE report, the fishing fleets off Alaska produced an estimated $564.9 million in ex-vessel gross revenues from the groundfish resources of the Bering Sea and Gulf of Alaska. In 2000, groundfish accounted for just over half of the $1.098.5 billion in ex-vessel gross revenues generated off of the Alaska by all fisheries (Hiatt, *et al.*2001).

The two most economically important groundfish species were pollock and Pacific cod. Pollock catches generated estimated ex-vessel revenues of $255.8 million and accounted for 45.3 percent of all ex-vessel revenues.[1] Pacific cod was the next most significant groundfish species, measured by the size of gross revenues. Pacific cod generated an estimated $162.8 million in ex-vessel gross revenues and accounted for about 28.8% of all groundfish gross revenues. (Hiatt, *et al.*, 2001).

Other groundfish species were economically important as well. These included sablefish ($80.4 million in estimated ex-vessel gross revenues), flatfishes (as a group of species generated $43 million in estimated ex-vessel gross revenues), rockfishes (as a group generated $9.9 million), and Atka mackerel generating $9.4 million. (Hiatt, *et al.*, 2001).

At the first wholesale level, the gross revenue generated by the groundfish fisheries off of Alaska were estimated to be in excess $1.36 billion. Over half of this, $686.6 million, came from catcher/processors and motherships operating in the Bering Sea and Aleutian Islands (BSAI). Another $399.4 million was generated by shoreside processors operating in the BSAI. In the Gulf of Alaska (GOA) $41.6 million was generated by catcher/processors and $199.1 million was generated by shoreside processors. (NMFS 2001c).

Information on net returns is scanty since there is little information available on costs. A rough estimate can be made for the BSAI pollock fishery, an important part of the overall fishery. The Alaska Department of Commerce and Economic Development (ADCED) reports that in 2000 the average royalty paid , per metric ton of pollock quota, by commercial operators to CDQ groups was $292.34 (ADCED, page 27). The first wholesale value of retained pollock harvests in the BSAI was about $806 per metric ton in 2000 (Hiatt, pers. comm.). This suggests that royalty payments to CDQ groups were about 36% of the first wholesale price of a metric ton of pollock in the Bering Sea in 2000.

Extrapolating this percent to the gross first wholesale value of the BSAI pollock harvest in 2000, (i.e., $798.1 million dollars [Hiatt, *et al.,* 2001]), suggests that resource rents from the pollock fishery might have totaled about $290 million in 2000. This would be a high estimate of the social value of the pollock fishery that year; an estimate of the true social return would have to make deductions for several factors, including: (a) public costs for management and enforcement, (b) potential depreciation of ecosystem capital (if any); (c) potential depreciation of endangered species assets (if any); (d) income accruing to residents of other countries.

Extrapolation of the royalty percentage to other segments of the groundfish fleet is almost certainly inappropriate. The BSAI pollock fishery operates under the CDQ and AFA programs and is almost certainly more efficient than the other fleet segments. Note, moreover, that this is an estimate of total returns from the whole BSAI pollock fishery. It would be inappropriate to adjust this total in proportion to changes in TACs in order to determine the social value of a TAC change. Marginal valuations, about which we have no information, would be appropriate for that purpose. Further, the measure of returns estimated above corresponds roughly to the economists measure of "producers surplus." This will exceed the profits of fishing operations by their annual fixed costs.

[1] As noted below, a large proportion of pollock is taken by catcher processors and ex-vessel prices are not generated. Ex-vessel prices have been inferred for these operations.

Catcher/Processors

Catcher/processors carry the equipment and personnel they need to process the fish that they themselves catch. In some cases catcher/processors will also process fish harvested for them by catcher vessels and transferred to them at sea. There are many types of catcher/processors operating in the BSAI and GOA groundfish fisheries. They are distinguished by target species, gear, products, and vessel size.

Pollock catcher/processors in the BSAI. These vessels (which use trawl gear) are referred to as the "AFA catcher/processors" because of the role played by the American Fisheries Act (AFA) of 1998 in structuring the fishing sector. The AFA: (1) recognized pollock trawl catcher/processors as a distinct industry segment, (2) limited access to the fleet, (3) modified the historical allocation of the overall pollock TAC that the fleet had received, and (4) created a legal structure that facilitated the formation of a catcher/processor cooperative.[2] The pollock at-sea processing fleet has two fairly distinct components - the fillet fleet, which concentrates on fillet product, and the surimi fleet, which produces a combination of surimi products and fillets. Both of these sectors also produce pollock roe, mince, and to varying degrees fish meal.

Trawl Head And Gut (H&G) catcher/processors. These factory trawlers do not process more than incidental amount of fillets. Generally they are limited to headed and gutted products or kirimi. In general, they focus their efforts flatfish, Pacific cod, and Atka mackerel. Trawl H&G catcher/processors are generally smaller than AFA catcher/processors and operate for longer periods than the surimi and fillet catcher/processor vessels that focus on pollock. A fishing rotation in this sector might include Atka mackerel and pollock for roe in January; rock sole in February; rock sole, Pacific cod, and flatfish in March; rex sole in April; yellowfin sole and turbot in May; yellowfin sole in June; rockfish in July; and yellowfin sole and some Atka mackerel from August to December. The target fisheries of this sector are usually limited by bycatch regulations or by market constraints and only rarely are able to catch the entire TAC of the target fisheries available to them.

Pot catcher/processors. These vessels have been used primarily in the crab fisheries of the North Pacific, but increasingly are participating in the Pacific cod fisheries. They generally use pot gear, but may also use longline gear. They produce whole or headed and gutted groundfish products, some of which may be frozen in brine rather than blast frozen. Vessels in the pot catcher/processor sector predominantly use pot gear to harvest Bering Sea and GOA groundfish resources. The crab fisheries in the Bering Sea are the primary fisheries for vessels in the sector. Groundfish harvest and production are typically secondary activities. Vessels average about 135 feet LOA and are equipped with deck cranes for moving crab pots. Most pot vessel owners use their pot gear for harvesting groundfish. However, some owners change gear and participate in longline fisheries.

Longline catcher/processor. These vessels, also known as freezer longliners, use longline gear to harvest groundfish. Most longline catcher/processors are limited to headed and gutted products, and in general are smaller than trawl H&G catcher/processors. The longline catcher/processor sector evolved because regulations applying to this gear type provide more fishing days than are available to other gear types. Longline catcher/processor vessels are able to produce relatively high-value products that compensate for

[2] There are non-pollock factory trawlers in the BSAI, about 25 'head and gut', or H&G factory trawlers, which target species other than pollock. Those vessels are not covered in this description.

the relatively low catch volumes associated with longline gear. These vessels average just over 130 feet LOA. In 1999, there were 40 vessels operating in this sector. These vessels target Pacific cod, with sablefish and certain species of flatfish (especially Greenland turbot) as important secondary target species. Many vessels reported harvesting all four groundfish species groups each year from 1991 through 1999. Most harvesting activity has occurred in the Bering Sea, but longline catcher/processor vessels operate both the BSAI and GOA.

Motherships

Motherships are defined as vessels that process, but do not harvest, fish. The three motherships currently eligible to participate in the BSAI pollock fishery range in length from 305 feet to 688 feet LOA.
Motherships contract with a fleet of catcher vessels that deliver raw fish to them. As of June 2000, 20 catcher vessels were permitted to make BSAI pollock deliveries to these motherships. Substantial harvesting and processing power exists in this sector, but is not as great as either the inshore or catcher/processor sectors.

Motherships are dependent on BSAI pollock for most of their income, though small amounts of income are also derived from the Pacific cod and flatfish fisheries in Alaska. In 1999, over 99 percent of the total groundfish delivered to motherships was pollock. About $30 million worth of surimi, $6 million of roe, and $3 million of meal and other products was produced from that fish. These figures exclude any additional income generated from the whiting fishery off the Oregon and Washington coasts in the summer. In 1996, whiting accounted for about 12 percent of the mothership's total revenue. Only one of the three motherships participated in the GOA during 1999, and GOA participation in previous years was also spotty. This is likely due to the Inshore/Offshore restriction that prohibits pollock from being delivered to at-sea processors in the GOA.

Catcher vessels

Catcher vessels harvest fish, but are not themselves equipped to process it. They will deliver their product at sea to a mothership or catcher/processor, or to an inshore processor. There are a wide variety of catcher vessels, distinguished by target species, delivery mode (i.e., at sea or inshore) and gear type.

AFA-qualified trawl catcher vessels Vessels harvesting BSAI pollock deliver their catch to shore plants in western Alaska, large floating (mothership) processors, and to the offshore catcher/processor fleet. Referred to as catcher vessels, these vessels comprise a relatively homogenous group, most of which are long-time, consistent participants in a variety of BSAI fisheries, including pollock, Pacific cod, and crab, as well as GOA fisheries for pollock and cod. There are 107 eligible trawl vessels in this sector, and they range from under 60 feet to 193 feet, though most of the vessels fishing BSAI pollock are from 70-130 feet. The AFA established, through minimum recent landings criteria, the list of trawl catcher vessels eligible to participate in the BSAI pollock fisheries. There is significant, and recently increasing, ownership of this fleet (about a third) by onshore processing plants.

Non-AFA trawl catcher vessel (greater than or equal to 60 feet in length) Includes all catcher vessels greater than or equal to 60 feet LOA that used trawl gear for the majority of their catch but are not qualified to fish for pollock under the AFA. They are ineligible to participate in Alaska commercial salmon fisheries with seine gear because they are longer than 58 feet. Vessels must have harvested a minimum of 5 tons of

groundfish in a year to be considered part of this class. The value of 5 tons of Pacific cod at $0.20 per pound is about $2,200. Non-AFA trawl catcher vessels greater than or equal to 60 feet also tend to concentrate their efforts on groundfish, obtaining more than 80 percent of ex-vessel value from groundfish harvests. Harvests of pollock by these vessels are substantially lower than those of the AFA qualified vessels, because they have not participated in the BSAI fisheries in recent years.

Pot catcher vessel These vessels are greater than or equal to 60 feet LOA and rely on pot gear for participation in both crab and groundfish fisheries. All vessels included in the class are qualified to participate in the crab fisheries under the Crab LLP. Some of these vessels use longline gear in groundfish fisheries. Pot catcher vessels traditionally have focused on crab fisheries, but have recently adopted pot fishing techniques for use in the Pacific cod fishery, which provide a secondary source of income between crab fishing seasons. Historically, the pot fishery in Alaska waters produced crab. Several factors, including diminished king and Tanner crab stocks, led crabbers to begin to harvest Pacific cod with pots in the 1990s. The feasibility of fishing Pacific cod with pots was also greatly enhanced with the implementation of Amendment 24 to the BSAI FMP, which allocated the target fishery between trawl and fixed gear vessels.

Longline catcher vessel Vessels greater than 60 feet LOA that use primarily longline gear. None of these vessels are qualified for the BSAI Crab LLP. A large majority of the longliner catcher vessels in this class operate solely with longline fixed gear, focusing on halibut and relatively high-value groundfish such as sablefish and rockfish. Both fisheries generate high value per ton, and these vessels often enter other high-value fisheries such as the albacore fisheries on the high seas. The reliance of these vessels on groundfish fisheries sets them apart from smaller fixed gear catcher vessels permitted to operate in Alaska salmon fisheries with multiple gear types. Overall, this fleet is quite diverse. Most vessels are between 60 and 80 feet long with an average length of about 70 feet. The larger vessels in this class can operate in the Bering Sea during most weather conditions, while smaller vessels can have trouble operating during adverse weather.

Shoreside Processors

AFA inshore processors There are six shoreside and two floating processors eligible to participate in the inshore sector of the BSAI pollock fishery. Three AFA shoreside processors are located in Dutch Harbor/Unalaska. The communities of Akutan, Sand Point, and King Cove are each home to one AFA shoreside processor. The shoreside processors produce primarily surimi, fillets, roe, meal, and a minced product from pollock. Other products such as oil are also produced by these plants but accounted for relatively minor amounts of the overall production and revenue. These plants process a variety of species including other groundfish, halibut, and crab, but have historically processed very little salmon. In total, the inshore processors can take BSAI pollock deliveries from a maximum of 97 catcher vessels, as of June 2000, according the regulations implemented by the AFA. The two floating processors in the inshore sector are required to operate in a single BSAI location each year, and they usually anchor in Beaver Inlet in Unalaska. However, one floating processor has relocated to Akutan. The two floating inshore processors have historically produced primarily fillets, roe, meal, and minced products.

Non-AFA inshore processors Inshore plants include shore-based plants that process Alaska groundfish and several floating processors that moor nearshore in protected bays and harbors. This group includes plants engaged in primary processing of groundfish and does not include plants engaged in secondary manufacturing, such as converting surimi into analog products (imitation crab), or further processing of other groundfish products into ready-to-cook products. Four groups of non-AFA inshore processors are described below. The

groupings are primarily based on the regional location of the facilities: (1) Alaska Peninsula and Aleutian Islands, (2) Kodiak Island, (3) Southcentral Alaska, and (4) Southeast Alaska.

Alaska Peninsula and Aleutian Islands Inshore Plants. In 1999, ten Alaska Peninsula and Aleutian Islands plants participating in the groundfish fishery. Between 1991 and 1999, almost all of the facilities reported receiving fish every year from the BSAI. In 1999, these facilities processed 66,635 round weight tons, of which 43,646 tons (66 percent) was pollock and 19,402 tons (30 percent) was Pacific cod. Also in 1999, 36,652 tons (55 percent of the total) came from the western Gulf of Alaska (WG) and 21,643 tons (32 percent) came from the BSAI.

Kodiak Island inshore plants Most Kodiak plants process a wide range of species every year, although generally fewer plants process pollock than process other species. The facilities processed a total of 101,354 round weight tons of groundfish in 1999, 51 percent of which was pollock and 30 percent of which was Pacific cod. All of the plants receive fish from the central Gulf (CG) subarea every year. Most of the plants also receive fish from the WG and eastern Gulf (EG) subareas.

Southcentral Alaska inshore plants. This group includes governmental units that border the marine waters of the GOA (east of Kodiak Island), Cook Inlet, and Prince William Sound. There have been 16 to 22 southcentral Alaska inshore processors participating in the BSAI and GOA groundfish fishery every year since 1991. In 1999, there were 18 plants in southcentral Alaska processing groundfish. All 18 plants reported processing Pacific cod, flatfish, and other groundfish species in 1999. In addition, 16 of the 18 reported processing pollock. Virtually all of the plants receive fish from the CG subarea every year. Many also receive fish from the EG subarea, and some receive fish from the WG subarea. In 1998 and 1999, fewer than four processors took deliveries from catcher vessels operating in the BSAI.

Southeast Alaska inshore plants. This group includes all shore plants in Southeast Alaska, from Yakutat to Ketchikan. Between 14 and 19 inshore plants operated in Southeast Alaska in the years from 1991 to 1999. There were 14 in 1999. In general, these plants focus on salmon and halibut, but also process some groundfish, particularly high-values species such as salmon and halibut.

Markets

Markets for three of the most important species, pollock, Pacific cod, and Atka mackerel, have been described in detail by Northwest Economic Associates and Knapp in Appendix D of the *Steller Sea Lion Protection Measures Draft Supplemental Environmental Impact Statement* (NMFS, 2001b). The reader is referred to that document for a more detailed report on these markets. The following discussion abstracts Section 5.3.2 ("Prices") of that appendix. This discussion focuses on pollock, Pacific cod and Atka mackerel because (a) the recent research for Appendix D has made information on these species relatively more available than information for other species, and (b) these three species together account for about 83% of groundfish first wholesale revenues in 2000 (Hiatt *et al.,* 2001).

The three most important pollock products are surimi, fillets, and roe. Alaska surimi is primarily consumed in Japan where it is considered to be a premium product; available substitutes for it are relatively limited. The prices received for pollock surimi will probably be relatively responsive to the quantity supplied to the market, so that there would be noticeable price increases if supply was reduced, and price decreases if supply was increased. These shifts should moderate or offset the revenue increases that would be associated with supply

increases, and revenue decreases associated with supply decreases. Similar conditions exist in the Japanese market for pollock roe.

Conditions are different in the market for fillets. Fillets tend to be sold into the relatively competitive U.S. market where there are relatively closer substitutes. Prices received for pollock fillets in that market may be relatively less responsive to changes in the quantity supplied. In this market, price changes would not tend to offset the revenue impacts of quantity changes.[3]

Pacific cod has a relatively close substitute in Atlantic cod and its price is unlikely to be strongly responsive to quantity changes. Atka mackerel from Alaska is a popular product in Japan and South Korea where most of it is consumed, and has relatively few strong substitutes. Its price is likely to be responsive to quantity changes. Thus Pacific cod price changes are relatively unlikely to modify quantity changes, while Atka mackerel prices are likely to modify quantity changes.

Safety

Commercial fishing is a dangerous occupation. Lincoln and Conway of the National Institute of Occupational Safety and Health (NIOSH) estimate that, from 1991 to 1998, the occupational fatality rate in commercial fishing off Alaska was 116/100,000 (persons/full time equivalent jobs), or about 26 times the national average of 4.4/100,000.[4] Fatality rates were highest for the Bering Sea crab fisheries. Groundfish fatality rates, at about 46/100,000 were the lowest for the major fisheries identified by Lincoln and Conway. Even this relatively lower rate was about ten times the national average.(Lincoln and Conway, page 692-693).[5] The danger inherent in commercial groundfish fishing was underscored by two accidents in March and April of 2001. In March, two men were lost when the 110 foot cod trawler Amber Dawn sank in a storm near Atka Island. In April, 15 men were lost when the 103 foot trawler-processor Arctic Rose sank about 200 miles to the northwest of St. Paul Island in the Bering Sea, while fishing for flathead sole.

However, during most of the 1990s commercial fishing appeared to become safer. While annual vessel accident rates remained relatively stable, annual fatality per incident rates (case fatality rates) dropped. The

[3]Technically, the demands for surimi and roe are described as relatively "inelastic," while the demand for fillets is described as relatively "elastic."

[4]To make accident rates easier to read and to compare across industries, all rates have been standardized in terms of the hypothetical numbers of accidents per 100,000 full time equivalent jobs in the business. The numerator, 116, is not the number of actual deaths; the denominator, 100,000, is probably at least five times the total number of full time equivalent jobs each year. In decimal form, this is a rate of .00116.

[5]The NIOSH study does not cover 1999-2001. Results updated through 1999 should be published in the summer of 2001; however, these results are not available at this writing. (Lincoln, pers. comm.). The rates are based on an estimate of 17,400 full time employees active in the fisheries. This estimate of the employment base was assumed constant over the time period. However, various factors may have affected this base, including reductions in the size of the halibut and sablefish fleets due to the introduction of individual quotas. These estimates must therefore be treated as rough guides. The updated results due in the summer of 2001 should include an updated estimate of the number of full time equivalent employees as well.

result was an apparent decline in the annual occupational fatality rate.[6] From 1991 to 1994, the case fatality rate averaged 17.5% a year; from 1995 to 1998 the rate averaged 7.25% a year. Lincoln and Conway report that "The reduction of deaths related to fishing since 1991 has been associated primarily with events that involve a vessel operating in any type of fishery other than crab." (Lincoln and Conway, page 693.) Lincoln and Conway described their view of the source of the improvement in the following quotation.

> The impressive progress made during the 1990s in reducing mortality from incidents related to fishing in Alaska has occurred largely by reducing deaths after an event has occurred, primarily by keeping fishermen who have evacuated capsized (sic.)or sinking vessels afloat and warm (using immersion suits and life rafts), and by being able to locate them readily, through electronic position indicating radio beacons. (Lincoln and Conway, page 694).

There could be many causes for this improvement. Lincoln and Conway point to improvements in gear and training, flowing from provisions of the Commercial Fishing Industry Vessel Safety Act of 1988, that were implemented in the early 1990s. Other causes may be improvements in technology and in fisheries management. The Lincoln-Conway study implies that safety can be affected by management changes that affect the vulnerability of fishing boats, and thus the number of incidents, and by management changes that affect the case fatality rate. These may include changes that affect the speed of response by other vessels and the U.S. Coast Guard.

Nevertheless, despite these implications, the exact determinants of incident rates, fatality rates, and other measures of fishing risk, remain poorly understood. In the current instance, reductions in the TAC would reduce fishing operation profitability and could lead fishermen to skimp on safety expenditures and procedures. Conversely, reduced profitability may reduce the number of active fishing operations and the numbers of vessel and fishermen placed at risk. The net impacts are difficult to untangle with our existing state of knowledge.[7]

CDQ

Through the Community Development Quota (CDQ) program, the North Pacific Fishery Management Council and NMFS allocate a portion of the BSAI groundfish, prohibited species, halibut and crab TAC limits to 65 eligible Western Alaska communities. These communities work through six non-profit CDQ Groups to use the proceeds from the CDQ allocations to start or support commercial fishery activities that will result in ongoing, regionally based, commercial fishery or related businesses. The CDQ program began in 1992 with the allocation of 7.5% of the BSAI pollock TAC. The fixed gear halibut and sablefish CDQ allocations began in 1995, as part of the halibut and sablefish Individual Fishing Quota Program. In 1998, allocations of 7.5% of the remaining groundfish TACs, 7.5% of the prohibited species catch limits, and 7.5% of the crab guidelines harvest levels were added to the CDQ program, while the CDQ allocation of pollock increased to 10% of the TAC.

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[6]This result is based on an examination of the years from 1991-1998. It does not reflect the losses in the winter of 2001.

[7]A more detailed discussion of safety issues may be found in Section 1.3.3.4 of Appendix C to the SSL SEIS (NMFS 2001c).

4.10.2 Direct and Indirect Impacts of the Alternatives

Impacts

This EA evaluates the significance of the same economic indicators used in the *Steller Sea Lion Protection Measures Draft Supplemental Environmental Impact Statement* (NMFS, 2001b) with the addition of an indicator for "Net Returns to Industry." This selection of indicators is relatively extensive, as the SSL SEIS (NMFS, 2001c) attempted to describe the impact of the protection measures on the costs and benefits accruing to all stakeholders. It is also appropriate to use this set of indicators since both the Steller sea lion protection measures and these specifications are under consideration for adoption at the same time. The indicators, which are listed on page 4-342 in Section 4.12.1 of the SSL SEIS, are:

Existence Values
Non-Market Use Value (e.g., subsistence)
Non-Consumptive Use Value (e.g., eco-tourism)
Fish Prices
Operating Cost Impacts
Groundfish Gross Values
Net Returns to Industry
Safety Impacts
Impacts on Related Fisheries
Consumer Effects
Management and Enforcement Costs
Excess Capacity
Bycatch and Discard Considerations

Each of these indicators was evaluated using the criteria described earlier in this EA.

Existence Values

Existence value is also called "non-use" value, because a person need never actually use a resource in order to derive value from it. That is, people enjoy a benefit (which can be measured in economic terms) from simply knowing that some given aspect of the environment exists. Survey research suggests that existence values can be significant in at least some contexts. Since existence values pertain to the continued existence of resources, the focus in this discussion is on classes of resources in the GOA and BSAI which have been listed as endangered under the U.S. Endangered Species Act. Under the Act, an endangered species is one that is "...in danger of extinction throughout all or a significant portion of its range..." and not one of certain insects designated as 'pests."(16 U.S.C. §1532(6).)

Changes in groundfish harvests in the GOA and the BSAI may affect (largely indirectly) existence values by affecting the probability of continued existence or recovery of a listed species. At present, four

endangered species or classes of endangered or threatened species exist in the GOA and BSAI: (a) Steller sea lions; (b) seven species of Great Whales[8]; (c) Pacific Northwest salmon; (d) three species of sea birds[9].

Sea lions and whales could be impacted if the specifications affected the groundfish prey available to them; sea birds could be affected if changes in specifications led to changes in opportunities for contact with fishing gear and for fishing gear induced mortality; salmon could be affected if specifications associated changes in groundfish fishing activity led to changes in salmon bycatch.

The Steller's sea lion will be protected by the reasonable and prudent alternatives (consistent with the Endangered species Act) that will be implemented in 2002. As noted in the discussion of "Bycatch and Discard Considerations" below, salmon harvests are already limited by prohibited species caps. Increases in fishing activity should not affect these stocks.

The mechanisms through which the fisheries might affect endangered species are poorly understood. Models that would relate fishing activity to changes in the probability that a species would become extinct are not available or do not yet have strong predictive power, and information on the ways in which existence values would change as these probabilities change is not available. Given this lack of information, the significance of this potential impact has been rated "unknown" for all alternatives.

Non-Market Use Value (e.g., subsistence)

While subsistence communities along Alaska's coast use small amounts of groundfish for subsistence purposes, groundfish are not one of the more important subsistence products. (NMFS, 2001b, page F3-109). Groundfish specifications, however, may affect subsistence harvests of other natural resources through two mechanisms: (1) they influence the levels of harvest of groundfish which may be used by other animals that are themselves used for subsistence purposes; (2) they influence the bycatch of prohibited species that have subsistence uses. Changes in groundfish harvests, for example, could affect the prey available to Steller's sea lions and thus affect sea lion population status and sea lion availability to subsistence hunters. Alternatively, changes in bycatch of prohibited species, particularly salmon and herring, could directly affect subsistence use of these species.

The mechanisms relating changes in the harvest of groundfish prey to changes in populations of animals used for subsistence purposes, and the mechanisms relating changes in populations of animals to changes in subsistence use are poorly understood. In addition, as noted later in this section, prohibited species bycatch is limited by bycatch caps and area closures. These measures limit groundfish harvests if necessary to protect prohibited species. It thus seems unlikely that Alternatives 1 through 4 might affect subsistence harvests by changing bycatch. Alternative 5, which completely shuts down the groundfish fisheries would reduce bycatch to zero; however, even under these conditions, it is not clear how much of the bycatch that had been eliminated would flow to subsistence fishermen, how much to commercial fishermen targeting

[8]Northern Right Whale, Bowhead Whale, Blue Whale, Fin Whale, Sei Whale, Humpback Whale, Sperm Whale (NMFS 2001b, 4-35).

[9]Short-tailed albatross, spectacled eider, and Steller's eider (NMFS 2001b, page 3-90).

bycaught species, and how much would be lost to natural mortality. For these reasons, this indicator has been given a significance rating of "unknown."

Non-Consumptive Use Value (e.g., eco-tourism)

Groundfish themselves do not support non-consumptive eco-tourism uses. Groundfish are preyed upon by marine mammals and birds that may themselves be the object of eco-tourism., and gear used in groundfish fishing may impose direct mortalities on sea birds. In the absence of a model describing how changes in specifications and fishing activity will impact marine mammals and seabirds, and a model relating eco-tourism values to the sizes and distribution of marine mammal and seabird populations, the significance of the impact of the alternatives on this indicator has been rated as "unknown."

Harvest Levels and Fish Prices

All other things equal, changes in the supply of a fish species should be associated with changes in the price received in the market for that species. Prices would be expected to drop when quantities rose, and would be expected to rise when quantities fell. The magnitude of the effect of the change of quantity on price would be affected by changes in the supplies of other fish species, and changes in a host of variables such as exchange rates, income, prices of non-fish food products, etc. In the alternatives under examination here, changes in the supplies from all other species in the BSAI and GOA would be correlated.

The information necessary to analyze the impacts of quantity changes on fish prices is extremely limited for species from the BSAI and GOA. Available statistical analyses are few and dated, and only available for some species; some anecdotal information is available. The SSL SEIS (NMFS, 2001c) contained a discussion of markets for pollock, Pacific cod, and Atka mackerel. It used economic theory and anecdotal information to make extremely rough estimates of the relative responsiveness of price to quantity for these species. These estimates are summarized in Section 4.10.1 of this EA. These are drawn on here to discuss price impacts on pollock, Pacific cod, and Akta mackerel.

In Section 4.10.1, the prices of pollock surimi and roe products, sold predominantly into Asian markets, were described as being relatively responsive to quantity changes, while the price of fillets, sold into competitive U.S. markets (and to a lesser extent, into European markets) were described as being relatively unresponsive to changes in supply. Pacific cod was described as having a relatively unresponsive price, while Akta mackerel was described as having a relatively responsive price. No explicit estimates of responsiveness were provided.

Alternatives 3 and 4 contemplate changes that are relatively modest, while Alternatives 1 and 2 contemplate very large quantity increases, and alternative 5 eliminates the harvest of the species completely. None of the information provided appears specific enough to estimate an impact under Alternatives 3 and 4. It seems likely that prices would fall given the large quantity increases projected under Alternatives 1 and 2. This is especially likely for pollock and Atka mackerel, perhaps less so for Pacific cod. Such a price decline should offset at least part of the increased revenue that might have been expected from increased production under these alternatives. Price would be undefined under Alternative 5, since no fish would be produced for sale.

Because of the responsiveness of the prices of certain pollock and Atka mackerel products to quantity changes, the large quantity increases associated with Alternatives 1 and 2 are assumed to lead to lower prices; there would be no price under Alternative 5. These three alternatives have been given "negatively significant" ratings. Alternatives 3 and 4 involve smaller changes from 2001 specifications levels. The price changes associated with these alternatives are likely to be much smaller, but can't be estimated with any precision. These alternatives have been given "unknown" significance ratings.

Operating Cost Impacts

Very little information about operating costs in the BSAI and GOA groundfish fisheries is available. Models that would predict behavioral changes associated with changes in the TACs and that would generate estimates of operating cost impacts associated with these behavioral changes are not available. It is therefore impossible to provide numerical estimates of the operating cost impacts associated with alternatives 1 to 4. However, it seems extremely likely that the production of larger volumes of fish (if that would even occur with the larger specifications) could only take place in association with larger variable costs in fishing and fish processing. Conversely, reductions in production imposed by reduced specifications would be likely to be associated with lower variable costs. Therefore, the operating costs indicator has been given a "negatively significant" rating for Alternatives 1 and 2 (which provide specifications larger than those in 2001, and an "unknown" rating for Alternatives 3 and 4 (with specifications much closer to those in 2001).

Under Alternative 5, no groundfish fishing would be allowed during 2002. In these circumstances, no costs would be incurred for active fishing operations. Fixed costs, incurred in advance of 2002 would continue to be incurred, as would some proportion of the maintenance costs for fishing vessels and gear. Fishermen would experience transitional expenses as they move into their next best alternative employment. However, on balance, fishing costs would be expected to decline. For this reason, Alternative 5 has been given a rating of "positively significant" for this indicator.

Groundfish Market Values

Information on gross revenue changes is summarized here. Gross revenues associated with each of the five alternatives are estimated in Section 4.10.4. The interested reader should turn to that section for a detailed discussion of the procedures and estimates. This section merely summarizes the impacts and discusses significance.

Gross revenues under each alternative were estimated separately for the BSAI and GOA. In addition to estimating gross revenues for the alternatives, 2000 gross revenues were also estimated for the BSAI and GOA. The gross revenues impacts and their significance are defined here with respect to the change between the alternative and the year 2000 estimates. BSAI 2000 gross revenues were estimated to be about $1.136 billion, while GOA 2000 gross revenues were estimated to be about $263 million. These changes are summarized in the following two figures.

Figure 4.10-1 shows the differences between the estimated BSAI gross revenues for each alternative, and the estimated gross revenues for 2000. Alternatives 1 and 2 are estimated to produce gross revenues over $1 billion more than 2000, Alternatives 3 and 4 are estimated to produce gross revenues approximately equal to those in 2000, and Alternative 5 is estimated to produce gross revenues over $1 billion less than 2000. As noted in the discussion of the gross revenues estimation in Section 4.10.4, biases in the approach used to make

the estimates suggest that the calculated differences for Alternatives 1 and 2 are probably overestimated. The difference calculated for Alternative 5 is approximately correct, since the groundfish fishery closed down under Alternative 5.

Figure 4.10-2 shows the differences between the estimated GOA gross revenues for each alternative, and the estimated gross revenues for 2000. Alternative 1 is expected to produce revenues about $50 million more than in 2000, Alternatives 2 and 4 are expected to produce gross revenues similar to those in 2000, Alternative 3 is expected to produce revenues over $100 million less than in 2000, and Alternative 5 is expected to produce gross revenues over $250 million less than in 2000.

Alternatives 1 and 2 have been given a "positive significance" rating on the basis of the large increases in gross revenues that appear to be associated with them. These increases appear to be large enough to remain significant even after the biases associated with the estimates are taken account of. Alternative 3 has been defined as "negatively significant." The impact under Alternative 3 is relatively small compared to those under Alternatives 1 2, and 5, but it is concentrated on the relatively smaller fisheries in the GOA and is large in that context. Alternative 4 has been rated "insignificant." Alternative 5 has been rated "negatively significant."

Net Returns to Industry

Although it has been possible to make crude estimates of gross first wholesale revenues under the alternatives, it is not possible to make corresponding estimates of net returns to industry. As noted under Section 4.10.1, "Description of the Fishery," net returns may be considerable. In that section, State of Alaska data on average lease payments for pollock CDQ rights was used to make estimates of economic profits to BSAI pollock fishing in 2000; these were about $290 million dollars. Closure of all groundfish fisheries for 2002 under Alternative 5, would reduce these returns, and any other fishery returns, to zero. Thus, Alternative 5 has been given a "negatively significant" rating for this indicator.

Specifications associated with gross revenues that are larger than current levels of production would relax constraints on fishermen and fish processors and would almost certainly be associated with higher levels of profits; specifications associated with lower gross revenues would increase the constraints on fishermen and would likely result in lower profits. These considerations have been used to assign "positively significant" ratings for Alternatives 1 and 2. Alternative 3 has been assigned a "negatively significant" rating on this criterion. Under Alternative 3, there appears to be a large proportional reduction in gross revenues, and presumably profits, in the GOA. Although there appears to be a modest proportional increase in gross revenues in the BSAI under Alternative 3, Alternative 3 has been given a "negatively significant" rating because of the importance of the GOA gross revenues (and implied profit impact) change in its context. The changes under Alternative 4 are relatively small and the impact on returns has been rated "unknown."

Safety Impacts

As described in Section 4.10.1, groundfish fishing off Alaska is a dangerous occupation. However, little is known about the connection between fisheries management measures and incident, injury, or fatality rates. Moreover, little is known about risk aversion among fishermen, or the values they place on increases or decreases in different risks. There is no way to connect changes in the harvests expected under these alternatives with changes in different risks, and the costs or benefits of these changes to fishermen.

Increases in TACs may improve fishing profitability and lead to greater investments in fishing vessel safety and greater care by skippers. This may reduce the fatality rate (although this is conjecture). Conversely, increases in TACs may increase the number of operations, the average crew size per operation, and the average time at sea. These may increase the potential population at risk, and the length of time individuals may be exposed to the risks. Without better information it is impossible to determine whether or not a given change in specifications will increase or decrease the number of accidents for Alternatives 1 to 4. Under the circumstances, these alternatives have been assigned a significance rating of "unknown." Alternative 5 stops all fishing for groundfish. Under these conditions, there would be no groundfish vessels at sea, and fatalities, injuries, and property damage, would drop to zero. Alternative 5 has therefore been assigned a rating of "positively significant."

Impacts on Related Fisheries[10]

Many of the operations active in groundfish fishing are diversified operations participating in other fisheries. Groundfish fishing may provide a way for fishermen to supplement their income from other fisheries and to reduce fishing business risk by diversifying their fishery "portfolios." Moreover, Pacific cod pot fishermen often fish for crab as well and Pacific cod harvests provide them with low cost bait. Changes in specifications and consequent changes in groundfish availability could lead to more or less activity by groundfish fishermen in other fisheries affecting competition in those other fisheries. Changes in specifications might affect the cost of bait for many crab fishermen.

In general, reductions in groundfish availability would be expected to have a negative affect on related fisheries, as fishermen move out of groundfish fishing and into those activities, or crab fishermen find bait costs rising. Conversely, increases in groundfish availability should have a positively significant impact on those fisheries. However, little is know about how these processes would take place and what their quantitative impacts would be. In the absence of this information, a significance rating of "unknown" has been assigned to Alternatives 1 to 4. Alternative 5, which closed the groundfish fisheries, was deemed to be such an extreme change that it was rated "negatively significant."

Consumer Effects

Domestic consumer losses will fall into two parts. One part, corresponding to the loss of benefits from fish products that are no longer produced, will be a total loss to society. This is often referred to as a "deadweight loss." The second part, corresponding to a reduction in consumer benefits because consumers will have to pay higher prices for the fish they continue to buy, will be offset by a corresponding increase in revenues to industry. This second part should not be treated as a "loss to society." It is a measure of benefits that consumers used to enjoy, but which now accrues to industry in the form of increased prices and additional revenues.

The deadweight loss cannot be measured with current information about the fishery. Estimation would require better empirical information about domestic consumption of the different groundfish species and products, and information about the responsiveness of consumers to the reduction in supply.

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[10]The impact of groundfish fisheries on fisheries for species that are prohibited catches in groundfish fisheries is discussed under another heading in this section.

The description of groundfish markets in Section 4.10.1 does suggest that for pollock, Pacific cod, and Atka mackerel, the impact on domestic consumers of increases or decreases in production might be fairly modest. Pollock surimi and roe and Atka mackerel were described as being principally sold overseas. Pacific cod and pollock fillets were described as being sold into domestic markets in which there were many competitive substitutes. Under these circumstances, consumers would be unlikely to gain or lose much from changes in supply.[11]

Consumers should gain at least some consumer surplus from increases in output, and would lose some from reductions in output. However we have no ability to measure these changes. Alternatives 1 to 4 have been given a significance rating of "unknown" for this indicator. Alternative 5, which does not allow groundfish fishing, was assumed to involve such a large change that it was given a "negatively significant" rating.

Management and Enforcement Costs

Enforcement and in-season management budgets for most of the 2002 fiscal year are already set and are unlikely to be changed much. Within these programs, however, resources could be reallocated to or from groundfish enforcement. Enforcement expenses are related to TAC sizes in complicated ways. Larger TACs may mean that more offloads would have to be monitored and that each offload would take longer. Both these factors might increase the enforcement expenses to obtain any given level of compliance. Conversely, smaller TACs may lead to increased enforcement costs as it becomes necessary to monitor more openings and closures and to prevent poaching (Passer, pers. comm.[12]) In-season management expenses are believed to be more closely related to the nature and complexity of the regulations governing the fishery (for example, on the number of separate quota categories that must be monitored and closed on time) than on TACs. Over a wide range of possible specifications, in-season management expenses are largely fixed. Increases in TACS from 50% above 2001 levels to 50% below 2001 levels could probably be handled with existing in-season management resources[13] (Tromble, pers. comm[14].).

Under Alternative 5, in which there would be no groundfish fishing in 2002, management and enforcement costs would be reduced, but not eliminated. Prohibitions on fishing activity would still need to be enforced to prevent poaching; however, enforcement expenses would be reduced because it would be immediately clear, in any instance, that a vessel found using trawl gear in the Federal waters would be in violation. NOAA enforcement might reprioritize to focus enforcement efforts on other issues. In-season management expenses and activities would be eliminated if there were no fishing in 2002, however, management and research efforts devoted to the longer term would still continue.

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[11] In economic terms, their demand curves would be relatively elastic and the changes in consumer surplus associated with changes in output would be relatively small.

[12] Jeff Passer. (2001). NOAA Enforcement. Personal communication. NMFS Alaska Region, P.O. Box 21668, Juneau, Alaska 99802. November 19, 2001.

[13] Although at low levels of TACs (but above a zero level) in-season management costs might increase due to the difficulties in managing numerous small quotas (Tromble, pers. comm.).

[14] Galen Tromble. (2001). National Marine Fisheries Service. Alaska Region, Sustainable Fisheries Division, P.O. Box 21668, Juneau, Alaska 99802 Personal communication. November 16, 2001.

Under these circumstances, this indicator has been given a rating of "unknown" for Alternatives 1 to 4, and a rating of "positively significant" for Alternative 5.

Excess Capacity

Net result of the interactions likely to occur within both the fishing and processing sectors on excess capacity are not quantified at present. It is likely that the effects under Alternatives 1 and 2 will lead to reduced excess harvesting and processing capacity, while the effects of the changes imposed under Alternative 3 will result in excess capacity in the harvesting sector in the GOA. However, there is no data or quantified estimates available to more fully understand these impacts. This indicator has thus been given an "unknown" rating for these alternatives. Alternative 5 shuts down the fishery for the year. The excess capacity under this alternative could at least be indicated by the numbers of vessels of different types that would be idled. In 2000, there were 1,244 catcher vessels and 44 catcher/processors catching groundfish in the GOA, and 1,288 catcher vessels and 88 catcher/processors catching groundfish in the BSAI (Hiatt *et al.*, 2001 [Table 27]). All of these would constitute excess capacity under Alternative 5. Alternative 5 has thus been given a "negative significant" rating.

Bycatch and Discard Considerations

Halibut, salmon, king crabs, Tanner crab, and herring are important species in other directed subsistence, commercial, and recreational fisheries. These species have been designated "prohibited species" in the BSAI and GOA groundfish fisheries. Groundfish fishing operations are required to operate so as to minimize their harvests of prohibited species, and, under most circumstances, to discard prohibited species if they are taken.

In the BSAI prohibited species are protected by harvest caps and/or the closure of areas to directed groundfish fishing if high concentrations of the prohibited species are present. Because of the caps or other protection measures, changes in the harvests in the directed groundfish fisheries, associated with the different specifications alternatives, should have little impact on catches of prohibited species. The exception is Alternative 5, which, in shutting down the groundfish fisheries, clearly would reduce associated prohibited species catches to zero.

In the GOA bycatch rates are typically low. The only average bycatch amounts that are meaningful in terms of numbers or weight in the Gulf of Alaska are Pacific halibut in the Pacific cod fishery, chinook salmon in the pollock fishery, other salmon (primarily chums) in the pollock fishery, and small amounts of *C. bairdi* crab in the Pacific cod fishery. (Ackley. pers comm[15]). Halibut is the only prohibited species managed under a cap in the Gulf. In the GOA, all the alternatives project allowable pollock harvests lower than the actual harvest in 2001. Thus the pollock impact on salmon should be reduced under all of these alternatives. The final set of Pacific cod quotas in the GOA management areas totaled 52,110 metric tons. Alternatives 3, 4 and 5 all project lower allowable catches, while Alternatives 1 and 2 project somewhat higher allowable catches. Presumably, Alternatives 3, 4, and 5 would be associated with lower *C. biardi* bycatches, while Alternatives 1 and 2 would be associate with higher bycatches.

[15] David Ackley. (2001). National Marine Fisheries Service. Alaska Region, Sustainable Fisheries Division, P.O. Box 21668, Juneau, AK 99802. Personal communication. November 14, 2001.

The primary impact of the prohibited species restrictions would come through: (a) operational changes to avoid prohibited species bycatch that increase the cost of groundfish fishing; (b) lost harvests due to closures triggered by reaching prohibited species catch limits; (c) costs and benefits incurred in fisheries directed on the prohibited species due to changes in groundfish prohibited species harvests. Behavioral and cost models that would make it possible to estimate the cost and benefit impacts of the prohibited species restrictions do not exist.

There is no quantitative method to 'link' the biological findings of prohibited species catch impacts, by alternative, to economic costs to fishing operations, nor is there a quantitative evaluation of the impacts that the different alternatives will have upon fish discards. For these reasons, the impacts of Alternatives 1 through 4 on prohibited species catches and on discards are rated as having an "unknown" impact. Alternative 5, with no groundfish fishing, as been given a "positively significant" rating. The bycatch limits would not impose additional costs on a fishery that was not operating, while the elimination of the groundfish fishery would eliminate all associated prohibited species harvests. The impact on bycatch could be roughly approximated by a reduction equal to the bycatches in a recent year attributable to groundfish fishing.

4.10.3 Detailed Analysis of 2002 Gross Value Impacts

The gross values analysis estimates gross revenues for products received at the first wholesale level, or "first wholesale gross revenues." First wholesale gross revenues were used as a measure of gross value since they provided the first price level common to two major sectors of the fleet: (1) the "inshore sector," comprised of catcher vessels that harvest fish and deliver them for processing to shoreside or at-sea processors, and these same processors; and (2) catcher/processor vessels that process their own harvest. It would be possible to estimate ex-vessel prices for the catcher vessels (i.e., reflecting revenues received for the first commercial transaction, in this case, between catcher and processor), however, those ex-vessel prices would not be comparable to the revenues received through the first commercial transaction of a catcher/processor, because the latter transaction involves a value added product, while the former reflects raw catch. Therefore, by employing a "first wholesale price" a comparable market level value is obtained for the two respective sectors of this industry.

The prices are defined as "first wholesale price per metric ton of retained catch." First wholesale prices are necessary for calculating gross revenues at the first wholesale level. Prices are in metric tons of retained catch by the fishermen. Retained catch differs from total catch because fishermen often discard parts of their total catch. This is an important factor in fisheries that take less desirable species as bycatch.

Price projections are not available for 2002. The most recent year for which relatively complete price data are available is 2000. The first wholesale price per metric ton of retained catch was calculated by dividing an estimate of gross first wholesale revenues by an estimate of retained catch. The estimate of gross first wholesale revenues was calculated using volumes of different products produced for wholesale markets (estimated from Weekly Processor Reports, WPRs) and estimates of first wholesale prices (produced from State of Alaska Commercial Operators Annual Reports, COAR reports). Estimates of the volume of retained catch, by species, were obtained from the blend. (Hiatt, pers. Comm.)

Gross revenues were estimated as the product of: (a) an estimate of the allowable harvest associated with the alternative; (b) an estimate of the proportion of the allowable harvest taken on average in 1998, 1999, and 2000; (c) an estimate of the proportion of the total catch that was discarded in 1998, 1999, and 2000; (d) a

first wholesale price per metric ton of retained weight calculated as described above. Species were grouped according to classifications used in the annual Groundfish Economic SAFE document before these calculations were made.

There are several important conceptual problems with this approach. First, changes in the quantity of fish produced, might be expected to lead to changes in the price paid. However, in this analysis, the same price was used to value the different quantities that would be produced under the different alternatives. Since, all else equal, an increase in quantity should reduce price, while a decrease in quantity should increase price, leaving price changes out of the calculation may lead to an exaggeration of actual gross revenue changes across alternatives. The magnitude of this exaggeration is unknown.

Second, many of the groundfish fisheries become limited by prohibited species catch limits, rather than attainment of TAC. Prohibited species catch limits are not proportional to groundfish specifications and are likely to bind sooner, or impose greater costs on groundfish fishermen, given higher levels of TAC specifications. This suggests that gross revenues for alternatives with generally higher levels of TAC specifications will be biased upward.

Other assumptions incorporated into the model may affect the results in ways that are difficult to determine. These include (1) the use of first wholesale prices per metric ton of retained weight implies that outputs at the wholesale level change in proportion to the production of the different species; (2) the use of broad species categories implies that changes in specifications would result in proportional changes in the harvest by all the gear groups harvesting a species; (3) similarly, the lumping of species together in categories implies that changes in specifications would result in proportional changes in the harvest of all the species included in the category.

Tables 4.10-1 and 4.10-2 summarize the gross revenue estimates in the BSAI and the GOA. Summaries are provided for each species grouping under each alternative.

Figure 4.10-1 **BSAI Gross Revenue Estimates: Difference Between Each Alternative and the 2000 Estimates (in millions of dollars)**

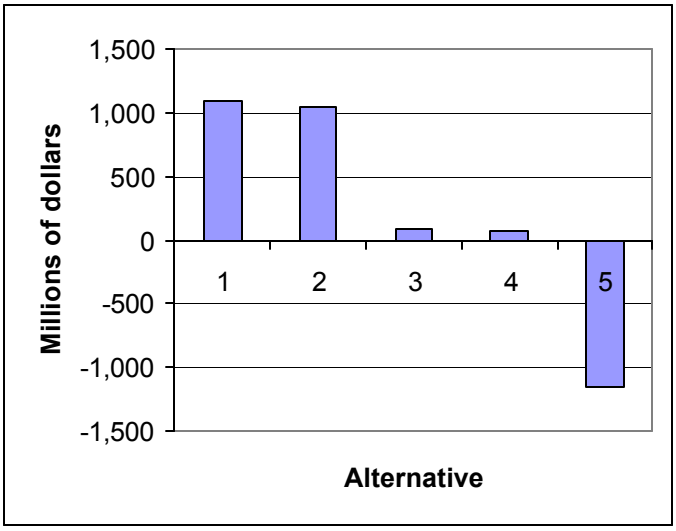

Figure 4.10-2 **GOA Gross Revenue Estimates: Difference Between Each Alternative and the 2000 Estimates (in millions of dollars)**

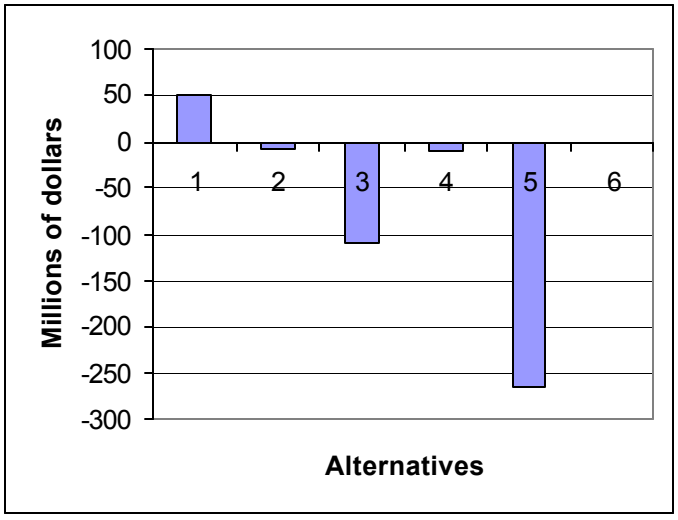

Table 4.10-1 Estimates of Gross revenues in the BSAI.

	Gross Revenue by Alternative (millions of dollars)				
	1	2	3	4	5
Pollock	1,779	1,779	978	933	0
Sablefish	15	12	8	11	0
Pacific cod	300	285	170	215	0
Arrowtooth	3	3	2	0	0
Flathead sole	16	16	8	3	0
Rock sole	28	28	14	5	0
Turbot	37	10	19	8	0
Yellowfin	19	19	10	17	0
Flats (other)	4	4	2	1	0
Rockfish	8	8	4	6	0
Atka mackerel	25	17	13	13	0
Other	1	1	0	1	0
Total	2,235	2,182	1,230	1,213	0
Notes: Cells may not sum to totals due to rounding.					

Table 4.10-2 Estimates of Gross revenues in the GOA.

	Gross Revenue by Alternative (millions of dollars)				
	1	2	3	4	5
Pollock	59	50	27	60	0
Sablefish	84	51	42	54	0
Pacific cod	122	107	61	124	0
Arrowtooth	11	11	6	1	0
Flathead sole	2	2	1	0	0
Rex sole	8	8	4	3	0
Flats (deep)	1	1	0	0	0
Flats (shallow)	9	9	5	1	0
Rockfish	16	16	8	10	0
Atka	1	0	0	0	0
Other	1	1	0	0	0
Total	313	256	154	254	0
Notes: Cells may not sum to totals due to rounding.					

5.0 Conclusions

To determine the significance of impacts of the actions analyzed in this EA, we considered the following as required by NEPA and 50 CFR § 1508.27:

Context: The setting of the proposed action is the groundfish fisheries of the BSAI and GOA. Any effects of the action are limited to these areas. The effects on society within these areas is on individuals directly and indirectly participating in the groundfish fisheries and on those who use the ocean resources. The proposed action includes changes to current fishing practices as well as continuation of harvest specifications for fishing year 2001. Because this action continues groundfish fisheries in BSAI and GOA into the year 2002, this action may have impacts on society as a whole or regionally.

Intensity: Listings of considerations to determine intensity of the impacts are in 50 CFR § 1508.27 (b) and in the NOAA Administrative Order 216-6, Section 6. Each consideration is addressed below in order as it appears in the regulations.

5.1 Adverse or beneficial impact determinations for marine resources accruing from establishment of year 2002 federal groundfish fisheries harvest specifications (see Table 5.0-1).

5.2 Public health and safety will not be affected in any way not evaluated under previous actions or disproportionally. Specifying TAC results in harvest quota assignments to gear groups, along previously established seasons, and according to allocation formulas previously established in regulations.

5.3 Cultural resources and ecologically critical areas: This action takes place in the geographic areas of the Bering Sea, Aleutian Islands, and Gulf of Alaska, generally from 3 nm to 200 nm offshore. The land adjacent to these areas contain cultural resources and ecologically critical areas. The marine waters where the fisheries occur contain ecologically critical area. Effects on the unique characteristics of these areas are not anticipated to occur with this action and mitigation measures such as a bottom trawling ban in the Bering Sea are part of fisheries management measures.

5.4 Controversiality: This action deals with management of the groundfish fisheries. There are differences of opinion among various industry, environmental, management, and scientific groups on the appropriate levels of TAC to set for various species and in particular areas.

5.5 Risks to the human environment by setting TAC specifications in the BSAI and GOA groundfish fisheries are described in detail in the draft SEIS (NMFS 2001). Because of the mitigation measures implemented with every past action, it is anticipated that there will be minimal or no risk to the human environment beyond that disclosed in the Draft Programmatic SEIS (NMFS, 2001a) or the Steller Sea Lion Protection Measures SEIS (NMFS, 2001c).

5.6 Future actions related to this action may result in impacts. NMFS is required to establish fishing harvest levels on an annual basis for the BSAI and GOA groundfish fisheries. Changes may occur in the environment or in fishing practices that may result in significant impacts. Additional information regarding marine species may make it necessary to change management measures. Pursuant to NEPA, appropriate environmental analysis documents (EA or EIS) will be prepared to inform the decision makers of potential impacts to the human environment and will strive to implement mitigation measures to avoid significant adverse impacts.

5.7 Cumulatively significant impacts beyond those described in the TAC setting SEIS (NMFS 1998a) are possible with this action. Fisheries are regulated by federal and state agencies in marine waters. NMFS and the State of Alaska work closely in setting harvest levels and managing the nearshore and

offshore fisheries of the state. In many instances, state fishing regulations are in addition to and more conservative than federal fishing regulations (Kruse, 2000). The state and federal fisheries are unlikely to cause cumulative effects beyond those described in the Draft Programmatic SEIS (NMFS 2001a) for the biological component of the BSAI and GOA.

5.8 Districts, sites, highways, structures, or objects listed or eligible for listing in the National Register of Historic Places: This action will have no effect on districts, sites, highways, structures, or objects listed or eligible for listing in the National Register of Historic Places, nor cause loss or destruction of significant scientific, cultural, or historical resources. This consideration is not applicable to this action.

5.9 Impact on ESA listed species: ESA listed species that range into the fishery management areas are listed in Table 5.0-2. The status of Section 7 consultations is summarized below by group: marine mammals, Pacific salmon, and seabirds.

ESA Listed Marine Mammals A Biological Opinion was written on Alternative 4 (the chosen alternative) for the Steller Sea Lion Protection Measures SEIS (NMFS, 2001c). The 2001 Biological Opinion concludes the Alternative 4 suite of management measures would not likely jeopardize the continued existence of the western or eastern populations of Steller sea lions, nor would it adversely modify the designated critical habitat of either population. It is important to point out that the 2001 Biological Opinion does not ask if Alternative 4 helps the Steller sea lion population size recover to some specified level so that the species could be delisted, but rather asks if Alternative 4 will jeopardize the Steller sea lion's chances of survival or recovery in the wild. While the Biological Opinion has concluded that Alternative 4 does not jeopardize the continued survival and recovery of Steller sea lions, it none-the-less identified four reasonable and prudent measures to include with Alternative 4 as necessary and appropriate to minimize impacts of the fisheries to Steller sea lions. The measures are: (1) monitoring the take of Steller sea lions incidental to the BSAI and GOA groundfish fisheries; (2) monitoring all groundfish landings; (3) monitoring the location of all groundfish catch to record whether the catch was taken inside critical habitat; and (4) monitoring vessels fishing for groundfish inside areas closed to pollock, Pacific cod and Atka mackerel to see if they are illegally fishing for those species.

ESA Listed Pacific Salmon When the first Section 7 consultations for ESA listed Pacific salmon taken by the groundfish fisheries were done, only three evolutionary significant units (ESU)s of Pacific salmon were listed that ranged into the fishery management areas (NMFS 1992, 1993). Additional ESUs of Pacific salmon and steelhead were listed under the ESA in 1997, 1998 and 1999. Only the Snake River fall chinook salmon has designated critical habitat and none of that designated habitat is marine habitat (Table 5.0-2). In 2000, formal consultation was reinitiated for all twelve ESUs of ESA listed Pacific salmon that are thought to range into Alaskan waters. A determination of not likely to jeopardize the continued existence is in the resulting biological opinion (NMFS 1999c). The FMP level consultation (NMFS 2000d) included reconsideration of all the listed species of Pacific salmon thought to range into the management area and redetermined no jeopardy for all ESUs. The Incidental Take Statements accompanying the biological opinions state the catch of listed fish will be limited specifically by the measures proposed to limit the total bycatch of chinook salmon. Bycatch should be minimized to the extent possible and in any case should not exceed 55,000 chinook salmon per year in the BSAI fisheries or 40,000 chinook salmon per year in the GOA fisheries.

ESA Listed Seabirds Two section 7 consultations regarding seabirds were reinitiated with USFWS in 2000. Consultations have not been concluded as yet. The first is an FMP-level consultation on the effects of the BSAI and GOA FMPs in their entirety on the listed species (and any designated critical habitat) under the jurisdiction of the USFWS (NMFS, 2000a). The second consultation is action-specific and is on the effects of the 2001 to 2004 TAC specifications for the BSAI and GOA groundfish fisheries on the listed species (and any critical habitat) under the jurisdiction of the USFWS (NMFS, 2000b). This action-specific consultation will incorporate the alternatives proposed in this SSL Protection Measures SEIS and the 2002 TACs for the groundfish fisheries. The most recent Biological Opinion on the effects of the groundfish fisheries on listed seabird species expired December 31, 2000. NMFS requested and was granted an extension of that Biological Opinion and its accompanying Incidental Take Statement (USFWS, 2001). USFWS intends to issue a Biological Opinion in late 2001. This will allow for the consideration of new information: recommendations by Washington Sea Grant Program on suggested regulatory changes to seabird avoidance measures based on a two-year research program as well as modifications to fishery management measure decisions informed by the Steller sea lion Protection Measures.

Reinitiation of Section 7 Consultation Section 7 consultations for ESA listed marine mammals or Pacific salmon are not being reinitiated for the year 2002 harvest specifications because none of the triggers for reinitiation are thought to have occurred. Those triggers include: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; and (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, the action agency must immediately reinitiate formal consultation.

Table 5.0-1 Summary of significant determinations with respect to direct and indirect impacts.

Coding: I = Insignificant, S = Significant, + = beneficial, - = adverse, U = Unknown					
Issue	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Marine Mammals					
Incidental take/entanglement in marine debris	I	I	I	I	I
Spatial/temporal concentration of fishery	I	I	I	I	I
Disturbance	I	I	I	I	I
Target Fish Species					
Fishing mortality	I	I	I	I	I
Spatial temporal concentration of catch	I	I	I	I	I
Change in prey availability	I	I	I	I	I
Habitat suitability: change in suitability of spawning, nursery, or settlement habitat, etc.	I	I	I	I	I
Non-specified Species					
Forage Fish / Area					
Smelt					
Other Forage Fish					
Smelt					
Other Forage Fish					
Prohibited Species Management - Pacific Salmon					
Condition of stocks	I	I	I	I	I
Harvest level in directed fisheries targeting salmon	I	I	I	I	I
Harvest level in directed groundfish fisheries	I	I	I	I	S-
Harvest level of prohibited species in directed groundfish fisheries	I	I	I	I	S+
Prohibited Species Management - Pacific Halibut					
Condition of stocks	I	I	I	I	I
Harvest level in directed fisheries targeting halibut	I	I	I	I	I
Harvest level in directed groundfish fisheries	I	I	I	I	S-
Harvest level in prohibited species in directed groundfish fisheries	I	I	I	I	S+
Prohibited Species Management - Pacific Herring					
Condition of stocks	I	I	I	I	I
Harvest level in directed fisheries targeting herring	I	I	I	I	I
Harvest level in directed groundfish fisheries	I	I	I	I	S-

Coding: I = Insignificant, S = Significant, + = beneficial, - = adverse, U = Unknown					
Issue	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Harvest level in prohibited species in directed groundfish fisheries	I	I	I	I	S+
Prohibited Species - Crab					
Condition of stocks	I	I	I	I	I
Harvest level in directed fisheries targeting crab	I	I	I	I	I
Harvest level in directed groundfish fisheries	I	I	I	I	S-
Harvest level in prohibited species in directed groundfish fisheries	I	I	I	I	S+
Northern Fulmar					
Incidental take–BSAI	U	U	U	U	U(S+)
Incidental take–GOA	I	I	I	I	I
Prey availability	I	I	I	I	I
Benthic habitat	I	I	I	I	I
Proc. waste & offal	U	U	U	U	U(S-)
Short-tailed Albatross					
Incidental take	U	U	U	U	U(S+)
Prey Availability	I	I	I	I	I
Benthic Habitat	I	I	I	I	I
Proc. Waste & Offal	I	I	I	I	I
Other Albatrosses & Shearwaters					
Incidental Take	U	U	U	U	U(S+)
Prey Availability	I	I	I	I	I
Benthic Habitat	I	I	I	I	I
Proc. Waste & Offal	I	I	I	I	I
Piscivorous Seabirds (Also Breeding in Alaska)					
Incidental Take	I	I	I	I	I
Prey Availability	U	U	U	U	U
Benthic Habitat	I	I	I	I	I
Proc. Waste & Offal	I	I	I	I	I
Eiders (Spectacled and Stellers)					
Incidental Take	I	I	I	I	I
Prey Availability	U	U	U	U	U
Benthic Habitat	U	U	U	U	U
Proc. Waste & Offal	I	I	I	I	I

Coding: I = Insignificant, S = Significant, + = beneficial, - = adverse, U = Unknown					
Issue	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Other Seabird Species					
Incidental Take	I	I	I	I	I
Prey Availability	I	I	I	I	I
Benthic Habitat	I	I	I	I	I
Proc. Waste & Offal	I	I	I	I	I
Marine Benthic Habitat					
Removal and damage to HAPC biota	I	I	I	I	I
Removal and damage to HAPC biota	I	I	I	I	I
Modification of nonliving substrates, damage to epifauna and infauna by trawl gear	I	I	I	I	I
Modification of nonliving substrates,	I	I	I	I	I
Changes to species mix	I	I	I	I	I
Economic Indicators					
Existence Values	U	U	U	U	U
Non-market Subsistence Use	U	U	U	U	U
Non-consumptive Use	U	U	U	U	U
Fish Prices	S-	S-	U	U	S-
Operating Cost Impacts	S-	S-	U	U	S+
Gross Revenues	S+	S+	S-	I	S-
Net Returns to Industry	S+	S+	S-	I	S-
Safety Impacts	U	U	U	U	S+
Impacts on Related Fisheries	U	U	U	U	S-
Costs to Consumers	U	U	U	U	S-
Management and Enforcement	U	U	U	U	S+
Excess Capacity	U	U	U	U	S-
Prohibited Species Catch	U	U	U	U	S+

Table 5.0-2 ESA listed and candidate species that range into the BSAI or GOA groundfish management areas and whether Reinitiation of Section 7 Consultation is occurring for these 2002 TAC specifications.

Common Name	Scientific Name	ESA Status	Whether Reinitiation of ESA Consultation is occurring
Blue Whale	*Balaenoptera musculus*	Endangered	No
Bowhead Whale	*Balaena mysticetus*	Endangered	No
Fin Whale	*Balaenoptera physalus*	Endangered	No
Humpback Whale	*Megaptera novaeangliae*	Endangered	No
Right Whale	*Balaena glacialis*	Endangered	No
Sei Whale	*Balaenoptera borealis*	Endangered	No
Sperm Whale	*Physeter macrocephalus*	Endangered	No
Steller Sea Lion (WesternPopulation)	*Eumetopias jubatus*	Endangered	No
Steller Sea Lion (Eastern Population)	*Eumetopias jubatus*	Threatened	Yes/No
Chinook Salmon (Puget Sound)	*Oncorhynchus tshawytscha*	Threatened	No
Chinook Salmon (Lower Columbia R.)	*Oncorhynchus tshawytscha*	Threatened	No
Chinook Salmon (Upper Columbia R. Spring)	*Oncorhynchus tshawytscha*	Endangered	No
Chinook Salmon (Upper Willamette .)	*Oncorhynchus tshawytscha*	Threatened	No
Chinook Salmon (Snake River Spring/Summer)	*Oncorhynchus tshawytscha*	Threatened	No
Chinook Salmon (Snake River Fall)	*Oncorhynchus tshawytscha*	Threatened	No
Sockeye Salmon (Snake River)	*Oncorhynchus nerka*	Endangered	No
Steelhead (Upper Columbia River)	*Onchorynchus mykiss*	Endangered	No
Steelhead (Middle Columbia River)	*Onchorynchus mykiss*	Threatened	No
Steelhead (Lower Columbia River)	*Onchorynchus mykiss*	Threatened	No
Steelhead (Upper Willamette River)	*Onchorynchus mykiss*	Threatened	No
Steelhead (Snake River Basin)	*Onchorynchus mykiss*	Threatened	No
Steller's Eider [1]	*Polysticta stelleri*	Threatened	Ongoing
Short-tailed Albatross[1]	*Phoebaotria albatrus*	Endangered	Ongoing
Spectacled Eider[1]	*Somateria fishcheri*	Threatened	Ongoing
Northern Sea Otter[1]	*Enhydra lutris*	Candidate	No

[1]The Steller's eider, short-tailed albatross, spectacled eider, and Northern sea otter are species under the jurisdiction of the U.S. Fish and Wildlife Service. For the bird species, critical habitat has been proposed only for the Steller's eider (65 FR 13262). The northern sea otter has been proposed by USFWS as a candidate species (November 9, 2000; 65 FR 67343).

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